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Mr. Bruce Halstead
U.S. Fish and Wildlife Service
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Dear Mr. Halstead,

This is a comment letter on the Pacific Lumber Company Habitat Conservation Plan and Sustained Yield Plan, which I will refer to below as the PALCO HCP, the HCP and the Plan. I am particularly concerned with the management of coho salmon (Oncorhynchus kisutch), chinook salmon (Oncorhynchus tshawystcha), steelhead trout (Oncorhynchus mykiss) and coastal cutthroat trout (Oncorhynchus clarkii). The information presented in the PALCO HCP shows clearly that the company's actions under the Plan will pose jeopardy to the continued existence of coho salmon, which is currently listed as a Threatened species under the Endangered Species Act (ESA). Therefore, I recommend denial PALCO's request for an incidental take permit by the National Marine Fisheries Service (NMFS). The NMFS permit number is 1157. I also have concern that actions under the HCP will cause local or widespread extinction of two sensitive amphibian species, the tailed frog (Ascaphus truei) and the southern torrent salamander (Rhyacotriton variegatus). These amphibians, which have similar habitat requirements to coho salmon, are also showing a declining distribution.

I am well versed on the potential risk of extinction of Pacific salmon species in the area covered by the PALCO HCP, and I have co-authored a white paper for the Humboldt Chapter of the American Fisheries Society entitled Factors in Northwestern California Threatening Stocks with Extinction (Higgins et al., 1992). Recently I served as principal researcher for a computer project to supply the public and agencies with data on fisheries and water quality on PALCO's land. The software used for organization and dissemination of the data is called the Klamath Resource Information System (KRIS) because it was devised in the Klamath Basin to help track the success of fisheries restoration there. KRIS Coho is the first application of the system outside the Klamath. KRIS Coho contains data from the PALCO HCP and from other agencies and entities that had scientifically valid fisheries and water quality information related to the area covered by the Plan. It also includes data interpretation, photographs and a full electronic bibliographic resource system. Many of the documents cited in my comments below are in electronic form in KRIS Coho. The information was pressed onto a CD ROM and disseminated to 1,000 members of the interested public, including agency personnel. A copy of the KRIS Coho CD is included as part of my comments.

The KRIS Coho project also has an electronic map component which was put together by the Humboldt State University Spatial Analysis Laboratory in the program ArcView. This project includes hydrography, elevation data, PALCO monitoring stations, Calwater planning watersheds, timber and vegetation types derived from Landsat imagery, distribution of tailed frogs and southern torrent salamanders in the Mattole River Basin and other useful layers. Parts of the KRIS Coho MAP project can be found as pictures within the KRIS Coho database program, but a full copy of the ArcView project is also included as part of my comments.

My comments are organized around the issues of compliance with the ESA and the California Environmental Quality Act (CEQA) including:

1. Why the topic is important
2. Is the information presented in the HCP sufficient to judge whether it meets legal standards of ESA and CEQA?
3. How do assertions in the HCP compare to other scientific literature or available data?
4. Will the companies actions violate ESA and CEQA provisions and particularly cause jeopardy to coho salmon.

In the sections that compare information in the HCP to the best available science, I have included information from KRIS Coho where it has bearing.

Sincerely,

Patrick Higgins

Pacific Salmon Distribution,Trends and Risk of Extinction and the PALCO HCP

Why this issue is important

An accurate assessment of salmon and steelhead distribution, populations trends and the risk of their extinction is important to judge sufficiency of entire HCP. An Incidental Take Permit cannot be issued for coho salmon without this information.

Does the HCP present sufficient information ot evaluate whether it meets biological and legal standards of ESA and NEPA with regard to this issue?

PH-1

The PALCO HCP does not use the "best scientific and commercial data available" as required under ESA (Section 7). Data sources which were ignored or not used properly can be found in the next section of these comments. The HCP cannot prove that it will not "appreciably reduce the likelihood of the survival and recovery of the species in the wild" (ESA, Section 7) because it does not accurately portray the status of Pacific salmon species at present.

The HCP does not reveal where fish may have ceased using tributaries in a WAA over time. The decrease in distribution of Pacific salmon species on PALCO's property is another indication of local extinctions or population fragmentations which is a step toward over-alll population extinction (Rieman et al., 1993). PALCO ignored trend data where it was available on the Mattole River and did not fully utilize fish data within California Department of Fish and Game (CDFG) Habitat Typing Reports to determine presence and absence of coho salmon on its property. The PALCO HCP also does not mention CDFG historical information that documents the local extinction of coho salmon and chinook salmon in the Bear River.

PALCO HCP assertions regarding fish distribution, trends and risk of extinction compared with other scientific literature and data

- **The HCP reports chinook salmon carcass numbers for the period between 1987 - 1995 as an aggregate number by Watershed Analysis Area (WAA). For some WAA's it is indicated which streams had the largest number of carcasses. (V4D S2 6-9)**

- **Nine hundred and twenty five coho salmon carcasses were reportedly found the North Fork Elk River, but the Plan does not indicate over how many years these surveys were conducted. There is a vauge assersion regarding Freshwater Creek that "the highest escapement levels of coho salmon observed occured in the three most recent years of sampling". (V4D S2 15-20)**

- **According to the HCP "virtually no data are available to determine the general abundance of distribution of cutthroat trout within streams on PALCO ownership". (V4D S2 27-28)**

- **Maps of the distribution of coastal cutthroat trout and coho salmon (V5 Map 16) do not reflect the known distribution according to California Department of Fish and Game (CDFG) file information.**

- **The HCP acknowledges, with citations from NMFS, Nehlsen et. al, 1991, and Brown et al, 1994, that most Pacific salmon species on their property have current, or pending, at-risk status under the Endangered Species Act (ESA). (V4D S2 6-28)** PH-1 CON.

- **Much more information was available to PALCO than it used. Other than vague assersions that the populations are "stable or increasing slightly" (V4D S2), the HCP makes no assessment of the status and trends of Pacific salmon species on, or downstream of, PALCO property.**

The PALCO HCP does not present salmon carcass data in a way that allows analysis of population trends. The carcass surveys were conducted between 1987-1995, but the number of carcasses counted in each year is not reported; only an aggregrate number for the eight year period is given. Data from salmon carcass surveys can be used to judge the level of extinction risk for coho salmon because they return almost invariably at age three. A pattern of low returns every three years is an indication of a weak year class, which is indicative of a weak population.

The Mattole Salmon Group has trend data for both chinook and coho salmon for the Mattole River since 1980. PALCO could have availed itself of this data but chose not to. While the counting effort each year may vary somewhat, the Mattole counts offer at least a rough index of trends. Since 1981, coho salmon returns to the Mattole have ranged from a high of approximately 1,000 spawners in 1987 to a low of 50 fish in 1990 (Figure 1). Chinook salmon returns to the Mattole River for the same period have ranged from a high of 3000 in 1981 to a low of 100 adults in 1990 (Figure 2).

In the early 1990's fewer than 200 adult coho were counted for several consecutive years, and there was concern they might be near extinction. The National Marine Fisheries Service (1997) estimated that the minimum viable population size for long term perpetuation of a salmon population is at least 200 individuals. Small population size can lead to loss of fitness and ultimately to extinction (Gilpin and Soule, 1990). The return of approximately 300 fish annually from 1995 to 1997 gives hope that the population is recoverable.

The PALCO HCP fails to mention that Bartley and Gall (1992) found that Mattole chinook salmon are a unique genetic strain. Both Mattole River chinook and coho salmon could represent very important gene resources for regional recovery strategies, including coastal rivers in Mendocino County. PH-2

PALCO did not use available juvenile salmonid data gathered from downstream migrant trapping and electrofishing surveys. CDFG has conducted hundereds of stream habitat surveys on PALCO lands yet the HCP presents none of the fish or habitat data from these surveys. Similarly, downstream migrant trapping data for Freshwater Creek, gathered by the Humboldt Fish Action Council (HFAC), was ignored. HFAC operated a downstream migrant trap on the mainstem of Freshwater Creek above the South Fork in 1989, when the forest in this watershed was largely late seral, having recovered from extensive logging that occured at the turn of the century. The downstream migrant trap sample shows that a diverse assemblage of salmonids and other aquatic vertebrate species inhabit streams of this forest type (Figure 3). PH-1 CON.

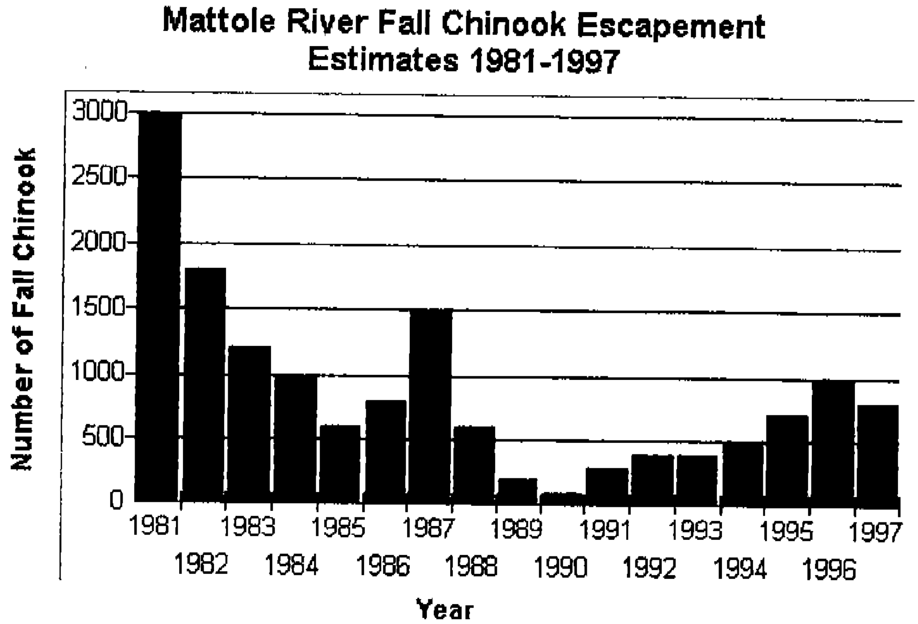


Figure 1. Chinook salmon returns to the Mattole River fell to very low levels from 1989-1991. Data provided by the Mattole Salmon Group from annual carcass surveys. Graphic from KRIS Coho.

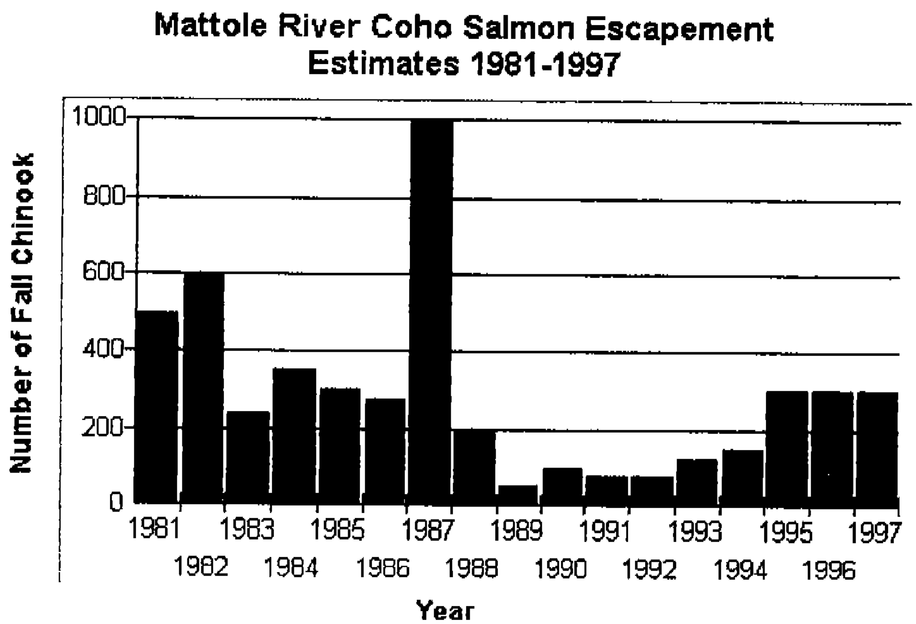


Figure 2. Mattole River coho salmon estimates fell below 100 fish from 1989-1992. Data provided by the Mattole Salmon Group. Graphic from KRIS Coho.

CDFG electrofishing samples conducted in conjunction with habitat reports are only a snapshot of the fish community but they can be useful. The surveys do not indicate whether chinook salmon may also use the streams surveyed because they are not present as juveniles during summer when samples are taken. However, the absence of coho salmon in creeks where they were formerly known to be occur gives evidence changes in distribution of coho salmon over time on PALCO's lands. Reeves et al. (1993) found that salmonid community st4ructure diminished in Oregon watersheds when timber hargvest levels exceeded 25%. They found that communities in disturbed watersheds tended to be dominated by one species of salmonid. This is what is found on PALCO lands with steelhead being the dominant species. Many of PALCO watersheds that have only steelhead have watershed disturbacne levels of over 50%.

PH-1 CON.

Fish sampling results from from the Van Duzen WAA, the Yager WAA and the Eel WAA all show community structures dominated by steelhead juveniles. While absence of coho juveniles in the samples does not prove total absence from a streams, CDFG habitat results from the same streams confirm in most cases that appropriate habitat was not available. Typically, the streams had few pools, highly embedded spawning gravels and low canopy cover. Fish community structure graphs for typical streams in these WAAs are shown in Figure 4 (Grizzley Creek), Figure 5 (Cooper Mill Gulch) and Figure 6 (Bear Creek). In those tributaries of the Eel River where water temperature problems are acute, California roach and Sacramento squawfish dominated samples, as the community structure graph for Yager Creek shows (Figure 7). Both these species can tolerate very warm water.

CDFG surveys found coastal cutthroat trout in Stitz Creek, near Scotia (Figure 8). This means that all lower Eel River tributaries proximate and downstream should be considered potential habitat. The PALCO fish distribution map incorrectly displays the range of coastal cutthroat trout and also does not show the natural range of coho salmon on its property. For example, CDFG file reports show clearly that coho salmon occurred in Hely Creek in the Van Duzen WAA (Hallock et al, 1952) in the Van Duzen WAA and Bear Creek (CDFG, 1992) in the Eel WAA yet these streams are not shown as part of the range of the species on the company's property. indicaPALCO also failed to note that summer steelhead were present in Yager Creek (CDFG, 1991).

The WAA areas designated in the HCP might actually serve well as Pacific salmon stock group designations for PALCO holdings, although there is no mention of the stock concept in the document. Ricker (1972) defined stocks as populations that spawn at the same place or time and which form distinct breeding populations. These stocks are adapted to local conditions in their home streams through generations of natural selection. The following is a characterization of fish population and habitat condition trends, based on the best available information.

<u>Humboldt Bay WAA</u>: Brown et al. (1994) estimated that in 1986-1987, 454 adult coho spawners, all wild fish, returned to Freshwater Creek. In 1987-88, they estimated that 834 coho returned, with 68% being of hatchery origin. Ellingwood (1998) reported dramatic drops in the number of coho spawners returning to Freshwater Creek since 1995, and cited watershed degradation and increased sediment levels related to intensive, recent logging as the principal causes. This is directly counter to the PALCO HCP assertion that runs in Freshwater Creek have been improving in recent years.

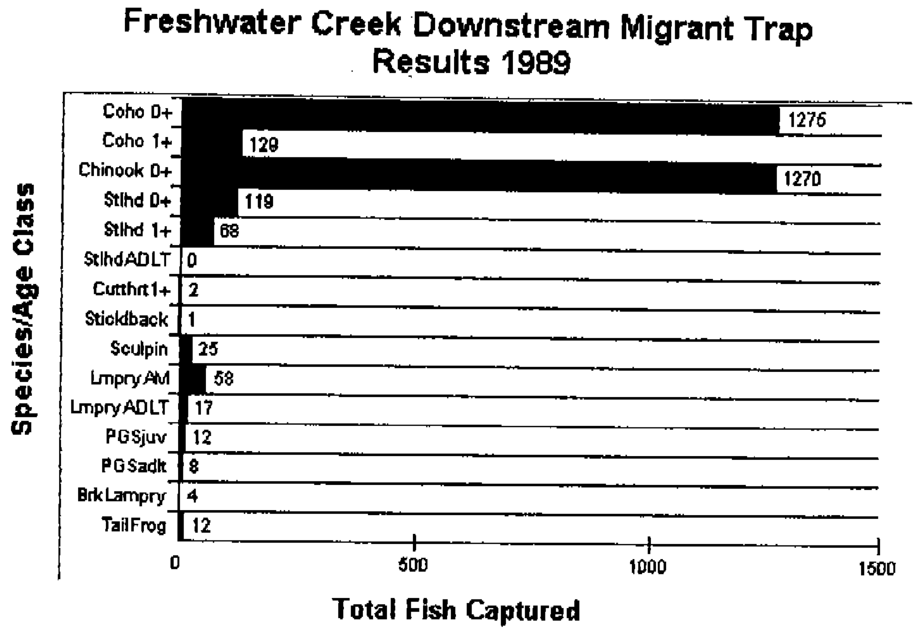


Figure 3. Freshwater Creek fish community structure in 1989 included four species of salmonids. This diversity is expected in a watershed in late seral conditions. Data from Humboldt Fish Action Council. Graphic from KRIS Coho.

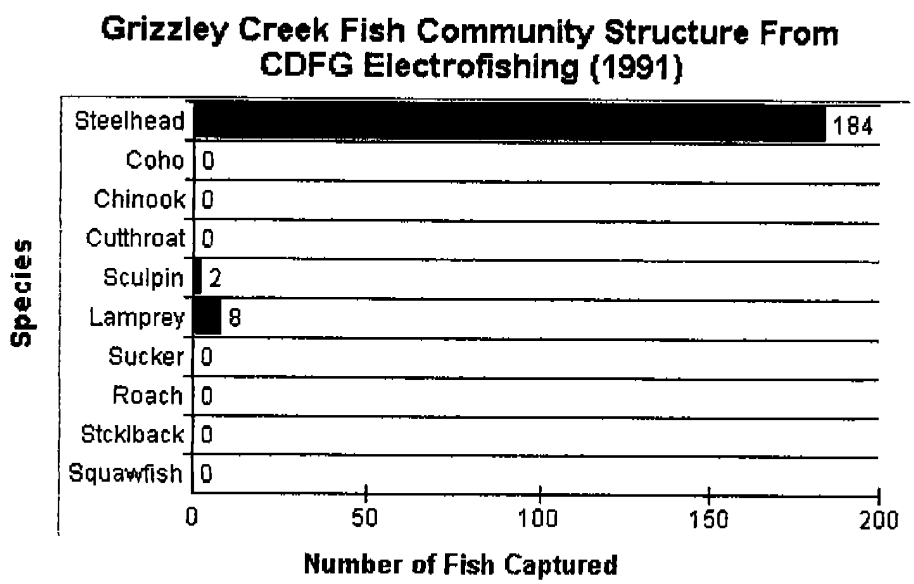


Figure 4. Grizzley Creek electrofishing samples did not include coho salmon, although they were formerly present in this stream. Data provided by CDFG. Graphic from KRIS Coho.

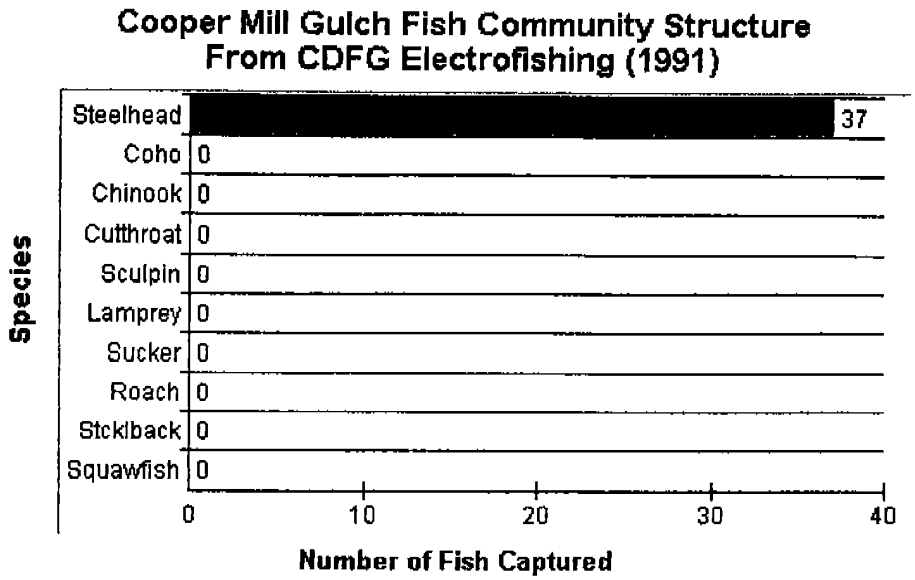


Figure 5. Electrofishing samples from Cooper Mill Gulch did not include coho salmon although they were formerly abundant in this stream. Data provided by CDFG. Graphic from KRIS Coho.

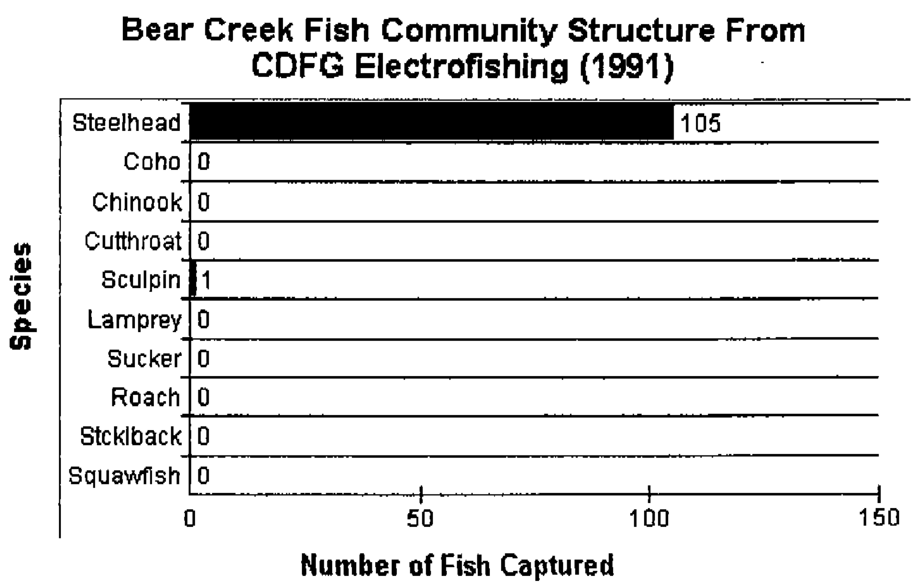


Figure 6. Electrofishing samples in Bear Creek, an Eel WAA tributary, did not include coho salmon, although they were formerly present. Data provided by CDFG. Graphic from KRIS Coho.

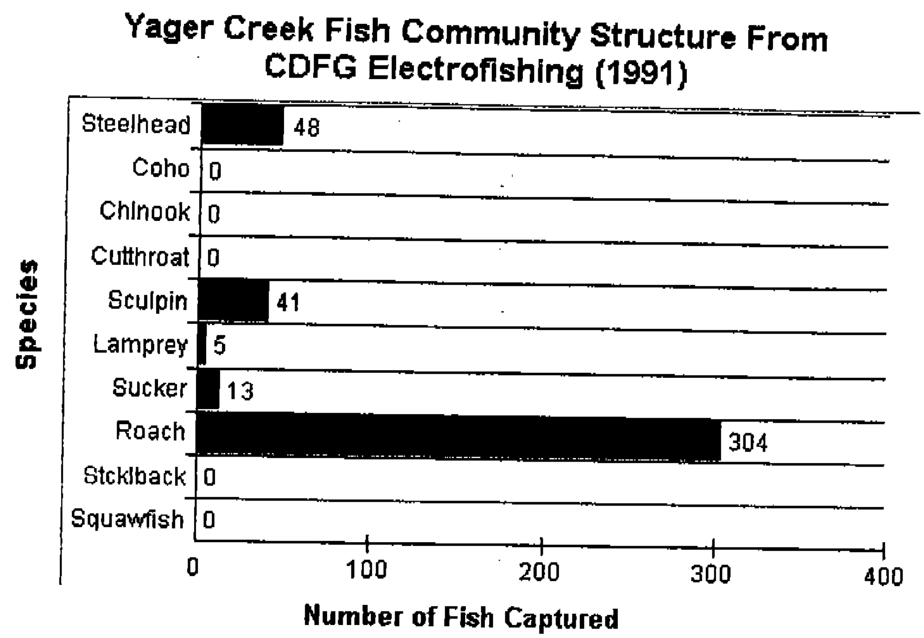


Figure 7. The electrofishing samples from Yager Creek in 1991 show a community dominated by warm water fishes. Data provided by CDFG. Graphic from KRIS Coho.

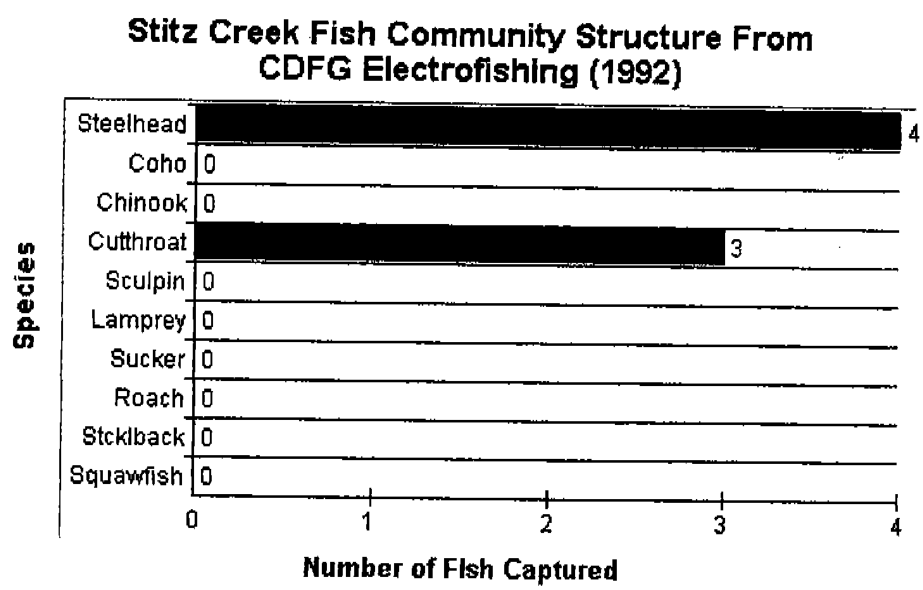


Figure 8. Electrofishing samples in Stitz Creek captured only seven specimens but the coastal cutthroat trout in this stream represent the furthest southern extension of this species in the Eel River Basin. Data provided by CDFG. Graphic from KRIS Coho.

In the Elk River, Brown et al. (1994) estimated an annual population of approximately 400 native coho salmon. The North Coast Regional Water Quality Control Board recently cited PALCO for violations of the State Water Code (Michlin, 1998) for sediment pollution in Elk River. Since 1995, the channel of the North Fork Elk River has been impacted by several feet of sediment deposition as a result of landslides triggered by PALCO logging. No data is available on recent coho salmon returns, but the population in this river is likely to be declining sharply. PH-1 con.

Eel River WAA: Tributaries of the lower Eel River affected by PALCO's management have had extremely high sediment contributions since 1995 (Michlin, 1998). The sediment has filled pools, increased fine sediment levels in spawning gravel and pushed stream temperatures over lethal limits for coho salmon. In these streams, temperature problems went from stressful to lethal following sediment deposition during and after the January 1, 1997 storm (Figure 9). CDFG surveys prior to 1994 found coho salmon adults or juveniles in many streams such as Bear Creek and Jordan Creek, but since the recent storm events, these streams are no longer suitable for coho salmon (Figure 10). The loss of rearing habitat in these tributaries may also impact coho juveniles seeking refuge from lethal temperatures in the mainstem Eel River during summer. Chinook salmon and cutthroat trout of the lower Eel River were charaterized by Nehlsen et al. (1991) as at moderate risk of extinction. It is my professional opinion that habitat changes on streams effected by PALCO management have certainly caused declines or local extinction of these species as well.

Van Duzen WAA: Hallock et al (1952) found coho salmon in many Van Duzen River tributaries such as Grizzley Creek, Cummings Creek and Hely Creek, but recent CDFG surveys did not find coho in these streams. Habitat information shows that these streams lack pools critical to coho survival (Figure 15) and temperatures are above habitable levels for coho (see Temperature). In short, it is my professional opinion that coho salmon have been virtually eliminated from the Van Duzen WAA. While the HCP indicates that Root Creek had more chinook salmon than other PALCO tributaries in the Van Duzen WAA, fine sediment is well above thresholds that would restrict egg survival (Figure 16). Alhtough no fishery data are available for years after 1994, many lower Van Duzen River tributaries suffered substantial damage to fish habitat following storm events (Figure 17).

Yager WAA: CDFG juvenile surveys in the Yager WAA also indicate that coho are absent or at extremely low levels. CDFG spawner and carcass surveys found only 14 coho salmon carcasses in eight years of surveys. Historical records from CDFG show that coho were formerly present in many streams in this WAA (Hallock, 1951; Lucy, 1972; Wood, 1964). Adverse habitat conditions, including lack of pools and stressful or lethal water temperatures, have almost completely eliminated coho. Sedimentation in Yager Creek during storm events since 1995 (Baker, 1995) are likely to have adversely effected chinook spawning habitat as well as coho habitat. A 1991 CDFG survey of Yager Creek noted a summer steelhead in the mainstem. The Van Duzen summer steelhead population is estimated to be fewer than 100 adults (Eric Gerstung, personal communication).

Bear/Mattole WAA: The chinook and coho salmon in the Bear River have been virtually extinct since 1955, however, according to the HCP, one chinook salmon juvenile was found in recent CDFG surveys. See preceeding section of these comments for Mattole population trends.

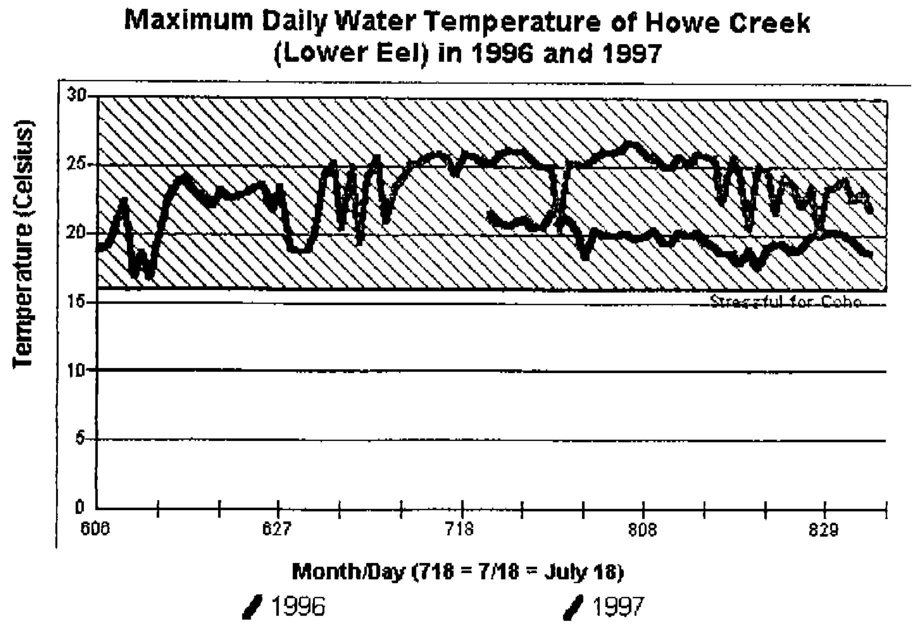


Figure 9. The water temperature of Howe Creek shifted from highly stressful to lethal for coho salmon after the stream became shallower and wider as the result of January 1, 1997 storm damage. This pattern is typical of Eel WAA tributaries. Data from the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

Figure 10. Photograph of Jordan Creek in January 1997 after major depositions of sediment. Pools for coho salmon rearing were filled in and fine sediment decreased suitable spawning habitat. Most other Eel WAA tributaries were similarly impacted. Photo by Doug Thron taken from KRIS Coho. Copyright Doug Thron.

The PALCO HCP does not deal with the topic of potential extinction. Rieman et al. (1993) is probably the best compendium providing insight into the risk of extinction for Pacific salmon species. Extinction occurs if the population death rate exceeds the population birth rate for a period of time. Rieman et al. (1993) identified three types of extinction risk: deterministic, stochastic and genetic. The most pervasive type of risk is deterministic, which is often related to human induced environmental change. Examples of this type of mechanism are increased sedimentation of streams and elevation of water temnperature in PALCO managed watershed. Competition with introduced species such as Sacramento squawfish is another risk of this type. PH-1

Once populations fall to very low levels they are more susceptible to extinction from stoichastic and genetic factors. Nelson and Soule (1986) estimated that the critically low level for salmon populations is 500 adults. Stoichastic events are those such as large floods or extremely poor ocean conditions which would reduce robust populations and may eliminate small or fragemented populations. Once populations fall to very low levels and remain there for a time, they may go extinct as a result of restricted genetic diversity (Gilpin and Soule, 1990).

<u>Will the quality of information in the PALCO HCP on this topic present potential problems with jeopardy under ESA and sufficiency under CEQA?</u> PH-3

The HCP does not straightforwardly address the distribution, status and trends of Pacific salmon species on PALCO property. The distribution maps do not show streams where coho salmon have occurred in the recent past. Although it is not explicitly stated in the HCP, this may indicate that the company does not intend to restore coho salmon to streams where they historically occurred but rather intends only to maintain them where they currently exist. Salmon populations persist over time through a reciprocal relationship with adjacent populations (Rieman et al., 1993). For example, if floods and earhtquakes blocked Yager Creek at sometime in history, coho salmon would have strayed into other Van Duzen River tributaries. After Yager Creek recovered, coho salmon from adjacent populations would have recolonized. The agragate of salmon populations in proximate areas is called a metapopulation. Natural salmon population dynamics cannot function with small isolated populations. The only way to restore coho salmon to a stable wild population is to restore them accross the landscape. To try to preserve existing small, isolated populations will leave all of them open to stoichastic events and greatly increase the likelihood of extinction.

The PALCO HCP fails to acknowledge that coho salmon are at extremely low levels in the Yager WAA, Van Duzen WAA and Eel WAA. The coho population in these WAA's may have fallen below critical levels for viability. Major sedimentation of the Elk River has reduced habitat quality and has probably caused substantial declines in coho in that stream as well. Regional stock information is also ignored. For example, Brown et al. (1994) pointed out that the upper main Eel River has lost its coho salmon population in recent time. The same study found in northern California, there are only seven populations of coho salmon larger than 200 adults annually, including the Elk River, Freshwater Creek and the Mattole River. The lack of recognition of the distribution, status and risk of extinction of coho salmon popualtions are a fundamental flaw in the HCP. If this Plan is adopted with these short comings, it is likely to provide insufficient protection for coho salmon to providfe for survival and recovery of the species.

Finally, there seems to be a clear relationship between levels of watershed disturbance and the ability to maintain a diverse salmonid community, including coho salmon (Reeves et al., 1993). Under the PALCO HCP, many watershed areas will be disturbed over 50-80% of their area within 15 years. This will lead to fish community structures dominated by steelhead or warm water fishes, wsuch as roach and squawfish in Eel River tributaries. This shows a failure to identify direct and cumulative effects under CEQA. High levels of watershed disturbance in the Plan will also pose direct jeopardy to coho salmon. . PH-3

REFUGIA AND COHO SALMON RECOVERY

Why this issue is important.

The scientific community has recognized that if Pacific salmon populations are to be conserved and restored, "a well dispersed network of high-quality refugia" must be preserved to serve as centers for population expansion (Spence et al., 1996). Refugia are streams with diverse habitat that provide viable habitat even during and following large storm events. They watersheds also support the most robust salmon populations. Natural population recovery of salmonids can take place when connectivity is maintained between high quality habitats to allow for reinvasion as degraded habitats recover (Spence et al., 1996).

Does the HCP present sufficient information on refugia to evaluate whether it meets biological and legal standards under ESA and CEQA? PH-4

No, the HCP does not present sufficient information to evaluate whether it protects refugia which are vital to the survival and recovery of coho salmon in northwestern California. The lack of information in the PALCO HCP on refugia and their distribution in northwestern California is a critical shortcoming. The potential for recovery of coho and chinook salmon can only be judged when the distribution of population centers is known and their proximity to stream reaches that are slated for recovery under the HCP can be estimated.

PALCO HCP assertions regarding refugia compared with other scientific literature and data

- **The PALCO HCP completely ignores the concept of refugia, although it does assert that "coho salmon escapement in the Humboldt WAA is at healthy levels." No other information on critical habitat for coho salmon or refugia is presented in the HCP.**

Brown et al. (1994) found only seven populations of coho salmon numbering over 200 in northwestern California: Redwood Creek, Freshwater Creek, Elk River, South Fork Eel River, Mattole River, Noyo River and Lagunitas Creek. Four of these populations may be somewhat inflated as a result of hatchery operations. Since a minimum population of 200 is needed for long term survival (NMFS, 1992), it is clear that there are few functioning populations of coho salmon left in the state. The remaining population centers of coho salmon are separated by hundreds of miles. Chinook salmon are extinct in Mendocino County (Higgins et al., 1992) and the Mattole River chinook salmon represent the only hope for restoration of this species in that area.

Does the HCP comply with the biological and legal standards with regard to this issue under ESA and CEQA?

The PALCO HCP fails to acknowledged that three of seven remaining viable populations of coho salmon in northwestern Cailfornia are within the project area. Local population centers such as these are absolutely critical in coho salmon recovery strategies because stocks of salmonids that are transferred over long distances have no chance of establishing new populations (Riesenbichler, 1988; Withler, 1982). The actions in the PALCO HCP are likely to jeopardize coho and chinook salmon in the Elk River, Freshwater Creek and the Mattole River. Loss of these populations will profoundly alter the chances for recovery of both these species in all of northwestern California. PK-4

Historically, salmon populations replenished themselves after cataclysmic events in a watershed through straying from adjacent watersheds (Rieman et al., 1993). Now populations of coho salmon are so far distant from one another that natural straying is unlikely to work as a mechanism for populations to restore themselves. It is likely that some extremely well planned human effort involving stock transfer and hatchery operation will be necessary to restore the species throughout its range in California. Populations of coho as described in Brown et al. (1994) are too small to serve as donor stocks for recovery efforts at present because they are at such low levels that taking eggs from the wild would be imprudent. Therefore, these populations need to be allowed to rebuild so that can serve as donor stocks for artificial culture and also help with natural, local population recovery in adjacent watersheds. Lack of recognition of metapopulation function and the concept of refugia make the HCP deficient with regard to use of best available scientific and commercial data.

Water Temperature and the PALCO HCP

Why this issue is important.
Salmon need cold water to survive and the thresholds for stress of juvenile coho salmon are well known (Brett, 1952; Armor, 1990). Studies in northern California (Hines and Ambrose, 1998) and southern Oregon (Frissell, 1994) have shown that juvenile coho salmon are not present in waters warmer than 16.5 degrees Celsius (C) and 17 degrees C, respectively. Streams in the Van Duzen WAA, the Yager WAA and the Eel WAA have pervasive high water temperatures. Without a clearer understanding of the mechnisms that drive water temperature, PALCO cannot possibly plan activities in an appropriate manner to conserve and restore coho salmon.

Does the HCP present sufficient information on water temperature to evaluate whether it meets biological and legal standards under ESA and CEQA?

PH-5

The PALCO HCP does not recognize the actual temperature needs for coho salmon and, therefore, does not deal honestly with how actions under the HCP will effect this species. PALCO also collected much more temperature data than is included in the HCP and presents no information about changes in water temperature over time. Furthermore, the PALCO HCP contends that direct shading is the only mechanism to prevent increases in water temperature which is a fundamentally flawed hypothesis (Spence et al., 1996). Thus, the HCP does not meet the standard of using the "best available scientific and commercial data."

Discussions of water temperature in the HCP deal only with Maximum Weekly Average Temperatures (MWAT). Values for all stations in a WAA are amalgamated into one average MWAT value for comparison. This type of presentation makes it impossible to determine which streams or reaches are most severely impaired with regard to temperature. Therefore, it is also impossible to judge whether actions under the Plan will adversely effect the survival and recovery of coho salmon.

Assertions by the PALCO HCP with regard to water temperature compared to the other scientific literature and available data

- **"There is some indication that fish in the southern end of the range may be able to tolerate higher temperatures." (Vol. 2F, page 6 of 43).**

- **"Cold-water fish, such as salmonids, generally require water temperatures below 20 degrees C." (V 4 H 11 of 132).**

Many of PALCO's assertions about stream temperatures are completely unsupported by the scientific literature. There are no data or recent studies that demonstrate there are temperature tolerant strains of coho salmon in California streams. In fact, studies from northwestern California show that coho avoid streams with temperatures greater than 16.5 degrees C (Hines and Ambrose, 1998). The assertion that 70 degrees F (21.1 degrees C) is the threshold for stress for salmonids is contradicted by numerous scientific studies, especially with regard to coho salmon (Brett, 1952; Armor, 1990; Fryer et al., 1976).

The optimal temperature range for coho growth and survival is 12-14 degrees C (Brett, 1952). Armor (1990) found that optimal growth rates for all salmonids occurs between 10-15.6 degrees C, and that no species continues to grow at temperatures over 19.10 C.

PH-5 con.

Table 1. Water temperatures for upper incipient lethal temperature, critical thermal maxima and growth for coho salmon and other salmonids.

UILT: Upper Incipient Lethal Temperature	26 degrees C	Brett, (1952) (as reported in Spence et al, 1996)
CTM: Critical Thermal Maxima	24.4 degrees C	McGreer et al (1991)
Growth stops	19.1 degrees C	Armor, (1990)
Optimal growth occurs	12-14 degrees C 10-15.6 degrees C	Brett, (1952) Armor, (1990)

Coho are susceptible to problems related to increased stream temperature because they spend an entire year in freshwater. Much of the data on salmon temperature tolerance is derived from laboratory experiments that may not reflect survival in streams. Lab experiments expose juvenile salmonids to varying acclimation temperatures, then raise the water temperature at different rates until 50% of the fish die. These tests have established lethal values for coho known as critical thermal maxima (CTM) and upper incipient lethal temperatures (UILT). Values for CTM, UILT and optimal growth for coho salmon are shown in Table 1.

It has not been established how these values relate to fish stress and mortality in nature. Fish in the wild must forage for food and avoid predation, while in laboratory environments the fish are fed and protected from predators. Stress is likely to occur at lower temperatures in the wild as the fish must also cope with all the variables of their environment. Field studies in southwestern Oregon streams found that coho, cutthroat and yearling steelhead rearing densities decreased sharply as temperatures exceeded 17 degrees C (Frissell et al., 1992.)

A substantial amount of research demonstrates that fish diseases become more virulent at temperatures over 16 degrees C (Fryer et al., 1976; Groberg et al., 1976 and 1983; Sanders et al.,1978). Fish disease organisms are always present in the water, but as young coho or other salmonid species become stressed by higher temperatures, their resistance drops. Even if these fish do not die from the disease once infected, they are more susceptible to predation and less able to compete for food. The PALCO hatchery on Cooper Mill Gulch in the Yager Creek basin has experienced major problems with fish diseases (CDFG, 1992) and the temperature is frequently greater than 16 degrees C (see Hatchery). Canopy on Cooper Mill Gulch was reduced from 80% to 40% between 1980 and 1991 (see Riparian).

Part of PALCO's holdings are in the Eel River drainage, where several non-native species of fish have been introduced, including Sacramento squawfish. Brown and Moyle (1990) found that salmonids were the most abundant species in cooler stream segments, but warm water fishes dominated in reaches with higher temperature. The squawfish non only out-competes young salmon and steelhead as stream temperatures warm but may also prey upon them. The HCP fails to acknowledge the extent of the problem with squawfish or the relationship of its activities to the spread of this species. PH-5 con

- **"For this study, temperatures were categorized as high (MWAT>18.4 degrees C) and low (<18.4 degrees C) The categories were chosen based on a review of thermal tolerances in coho salmon and steelhead trout." (V2H 16 of 42).** PH-6

There is no supporting documentation for this method of categorizing stream tempertures as low or high. The 18.4 degrees C upper limit of the "low" category is nearly two degrees Celsius higher than the temperature at which coho salmon were found to occur on Georgia Pacific lands in Mendocino County (Hines and Ambrose, 1998). NMFS has published two sets of guidelines that establish optimum water temperatures for salmonids. In "Coastal Salmon Conservations: Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast" (1996), optimim levels are defined as 10-14 degrees C, and streams with water temperatures over 17 degrees C are characterized as "not functioning properly". The Aquatic Properly Functioning Condition Matrix (NMFS, 1997), developed during discussions with PALCO over the HCP, defines optimal temperatures as 11.8-14.6 degrees C. and sets an upper limit for coho rearing conditions at an MWAT of 16.8 degree C. Finally, the use of MWATs does not allow analysis of factors such as actual peak temperatures and durations of warm water periods.

- **As part of the monitoring plan, the HCP proposes to conduct statistical analysis of water temperature data, and states that a "correction factor will be developed that will allow the observed water temperatures to be adjusted for differences in thermal loading for air temperature variation". (V4D 115 of 132)** PH-7

- **"Water temperature data must be collected for at least 5 years before any trend could be detected." (V4D 111 of 132).**

The PALCO HCP provides only a fraction of the data that the company has collected. The document states that variations in air temperature between years may lead to false conclusions that water temperatures are rising when the changes may be due to the increased air temperatures. The company's proposal to subject water temperature data to a statistical analysis which will include a "correction factor" for air temperature is unnecessary. In fact, the changes in water temperatures on many of PALCO's streams are so dramatic that differences can be detected quite clearly without rigourous analysis or correction factors.

Bear Creek and Canoe Creek are influenced by the same air temperatures since they are within the same climatic region of the Lower Eel River. Figure 11 shows Bear Creek water temperature in 1996 and 1997. Temperatures went from stressful to lethal limits in one year. During the storm of January 1997, Bear Creek experienced numerous debris torrents, 85% of which orginated on land recently logged by PALCO (PWA, 1998). The sediment filled pools and caused stream widening which substantially increased convective heat exchange between the atmosphere and the stream. For example, little heat exchange occurs between the water at the bottom of a deep pool and the air. However, a stream less than six inches deep is much more subject to heat exchange. In Canoe Creek , a nearby tributary, temperature differences between 1996 and 1997 are more typical of

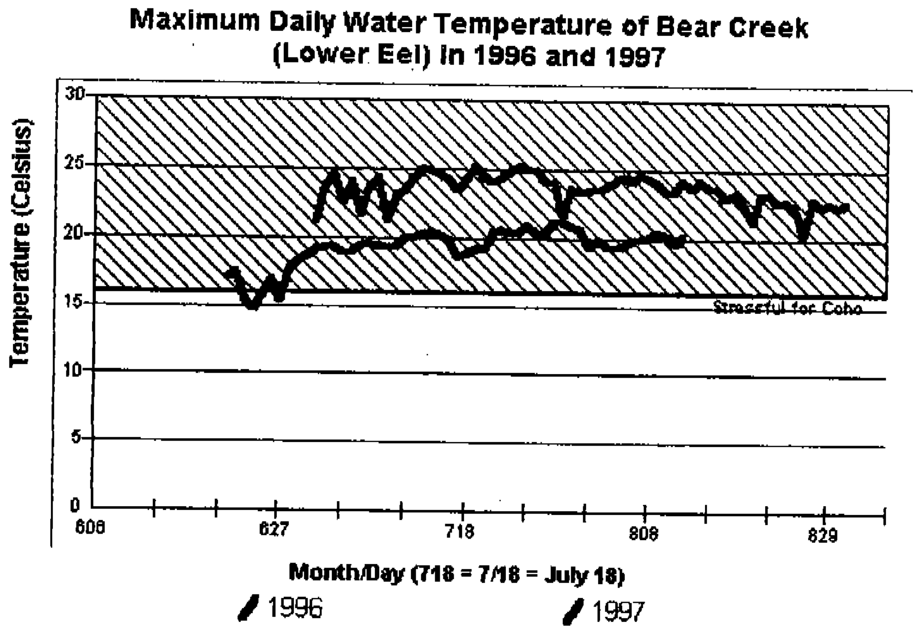


Figure 11.The water temperature of Bear Creek shifted from highly stressful to lethal for coho salmon after the stream became shallower and wider as the result of January 1, 1997 storm damage. This pattern is typical of Eel WAA tributaries. Data from the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

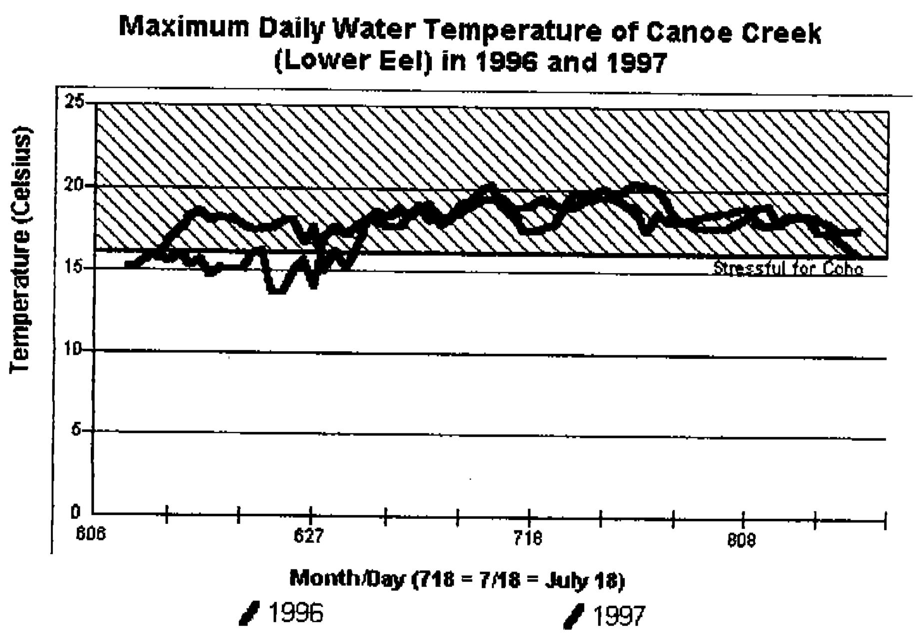


Figure 12. The maximum daily water temperature in Canoe Creek shows that water temperatures stayed in the same range between 1996 and 1997. This suggests that the range of air temperatures between the two years is similar and that the stream has not changed. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

inter-annual variability. One can conclude that temperature increases in Bear Creek are significant and not owing to air temperature differences between the two years. This also shows that you do not need five years of data to discern a trend. PH-7 con.

- **"Fish are mobile, so on the few days each year when temperatures exceed ULIT, they probably move up the tributaries or take refuge in cool pools." (Vol. 2F, page 6 of 43)** PH-8

Another flawed assumption made in the HCP is that fish can avoid lethal water temperatures on PALCO property on the "few days each year" they occur by moving up to cool tributaries or residing in cool pools. Water temperatures in many streams on PALCO lands reach stressful or lethal temperatures for weeks at a time. Figure 13 shows maximum daily water temperatures of Yager Creek, North Fork Yager and Lawrence Creek. Yager Creek above Lawrence Creek exceeded 25 degrees C more than five times in 1997 and the North Fork remained over lethal temperatures for two months. Although as recently as 1972 Lawrence Creek was cool enough to support coho salmon rearing (CDFG, 1972), maximum water temperatures exceeded stressful limits for coho salmon almost every day for the entire summer of 1997. Problems with sedimentation have resulted in a pool frequency of only 13% by length on Lawrence Creek (Figure 14). The limited number and restricted depth of pools means there are actually very few places fish can use to escape from warm water.

Problems also exist in other PALCO WAA's with availability of cold water refuge areas. In the Eel WAA, the mainstem Eel River runs at lethal temperatures for coho for much of the summer (Figure 15). In the past, juvenile coho salmon migrating downstream in early summer could take refuge in tributaries of the lower Eel River, but water temperatures are now considerably elevated in these streams (Figure 16). The Van Duzen WAA has similar problems. The mainstem Van Duzen River maximum daily water temperature exceeds lethal levels for prolonged periods during summer (Figure 17). The water temperatures of Van Duzen River tributaries on PALCO property have also warmed substantially and in 1997 maximum daily water temperatures were consistently over stressful for coho (Figure 18).

- **"Of these factors, shade, and in some cases, channel morphology, are the only variables that can be managed to reduce the adverse affects of timber harvest on water temperature within forested streams." (V4D 73 of 132).** PH-9

The PALCO HCP is fundamentally flawed when it contends that water temperature is most effected by direct shading. In fact the greatest influence on maximum water temperature is the air temperature over the stream (Bartholow, 1989). Relative humidity is the second greatest influence and shading ranks third (Bartholow, 1989). A complete, multi-tiered canopy that extends well back from the stream creates a cool microclimate and keeps relative humidity high (see Riparian). Ground water is generally 10-11 degrees C and small streams begin at this temperature. This cool ground water helps to create cool night time air temperatures under the canopy. The lack of air movement during the day because of dense forest surrounding and well back from the stream helps to maintain cool air even if upland ambient air temperatures are much higher on summer days. PALCO contention that cool water temperatures cannot be achieved in interior areas where summer air temperatures are hot is false. See discussion of recent studies by the U.S. Forest Service Redwood Sciences Lab related to this issue below.

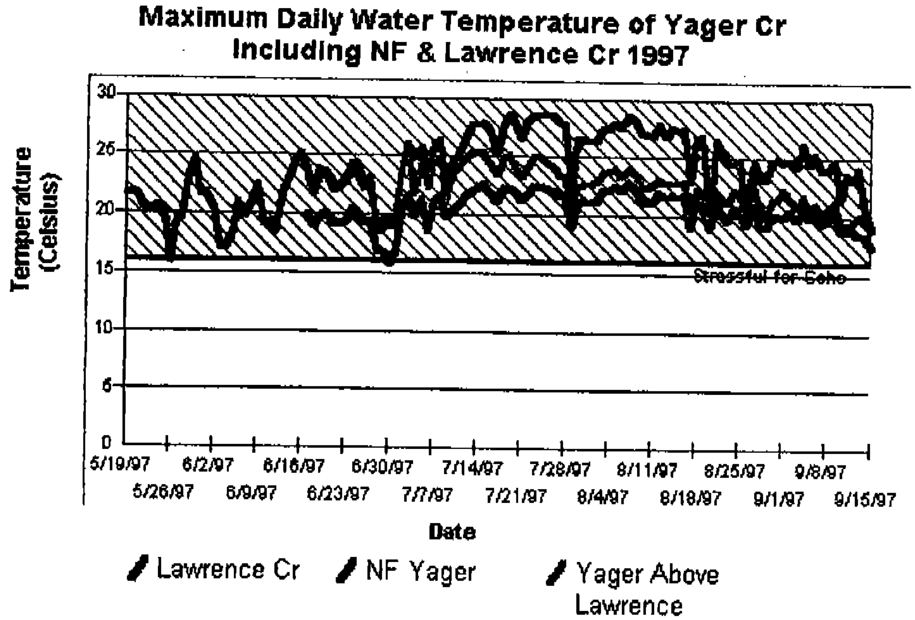


Figure 13. Maximum daily water temperatures in 1997 exceeded stressful levels for salmonids in the North Fork and mainstem of Yager Creek as well as in Lawrence Creek. North Fork temperatures exceeded lethal limits for over a month. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

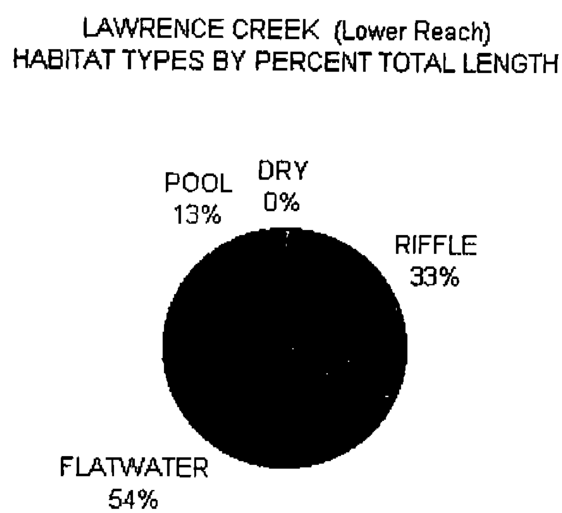


Figure 14. Pool frequency by length in Lawrence Creek was 13% as of 1991, which is much less than optimal for salmonid production. Loss of pools is due to high sediment transport in Lawrence Creek. Data from CDFG. Graphic from KRIS Coho.

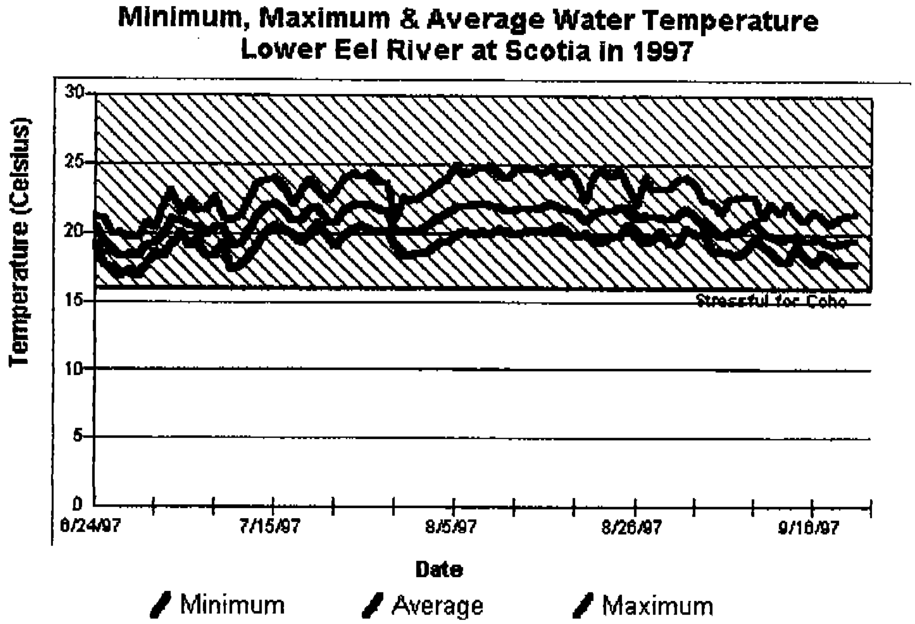


Figure 15. The mainstem Eel River at Scotia is above stressful or lethal temperature limits for salmonids throughout summer. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

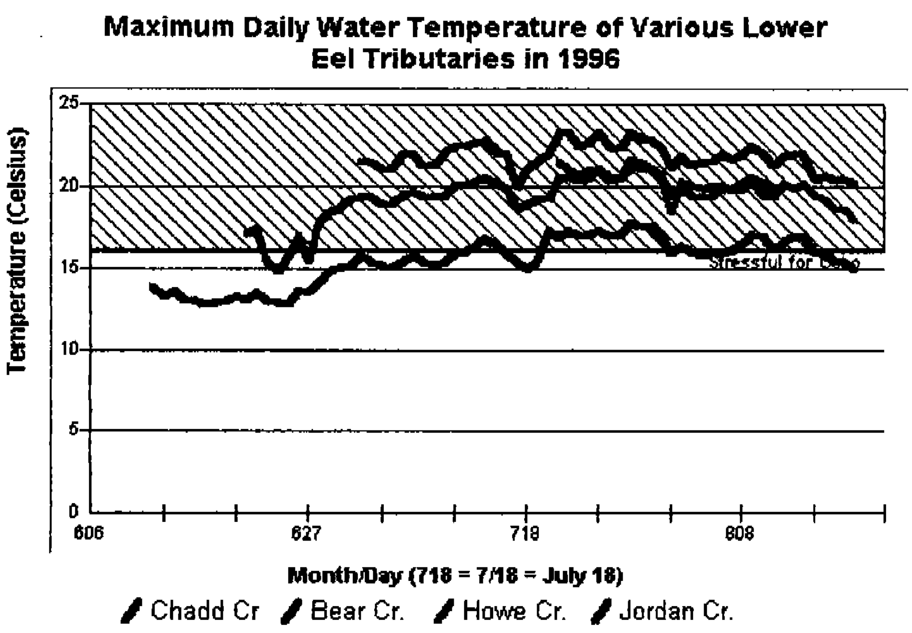


Figure 16. These Eel WAA tributaries all are partially managed by PALCO and they all exceeded stressful water temperature limits for coho salmon for some duration during 1996. These streams, with the possible exception of Chadd Creek, no longer provide cold water refuge areas for salmonids in the lower Eel River. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

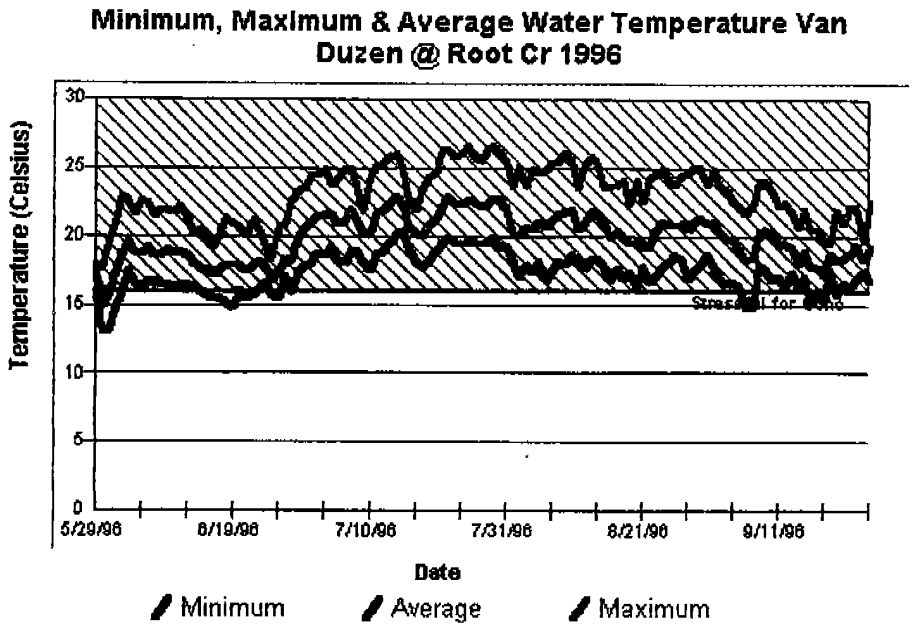


Figure 17. The Van Duzen River reached lethal temperature levels for salmonids for many consecutive days in 1996. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

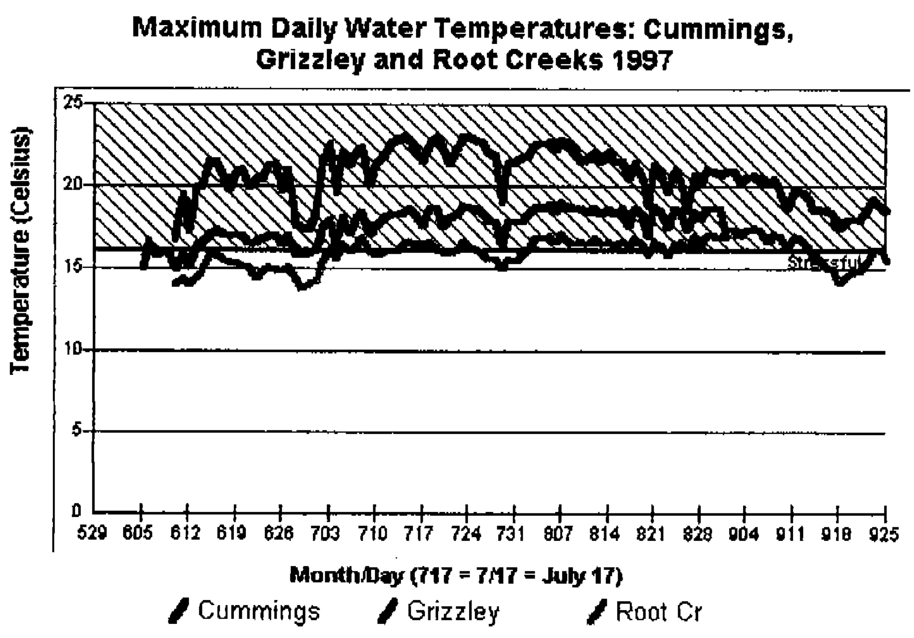


Figure 18. Tributaries flowing from PALCO lands in the Van Duzen WAA were too warm to provide cold water refuge for coho during the summer of 1997. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

PALCO also ignores other factors in stream warming related to increased sediment in streams. As demonstrated above, streams become wider and shallower when major influxes of sediment occur. The wider shallower stream is more subject to heat exchange with the atmosphere. The combination of high ambient air temperature over the stream due to riparian canopy thinning or removal and increased width to depth ratio due to sediment increases have pushed temperatures for many streams on PALCO lands to highly stressful or lethal conditions for coho salmon. PH-9 CON.

- **"Similarly, on PL's lands it appears that there is an east-west gradient in stream temperatures; streams nearer the coast are generally cooler than those further inland. For all these reasons it is not reasonable or practical to set a single effectiveness goal for streams on PLís ownership (e.g., Stream temperatures should not exceed 16 degrees C)." (V4D 111 of 132).** PH-10

- **"In our smaller forested tributaries, peak water temperatures are generally between 60o and 70 degrees F." (Vol. 2F, page 6 of 43).**

Recent studies by the U.S. Forest Service Redwood Sciences Lab on the Mattole River show conclusively the relationship between riparian canopy seral stage and water temperatures of small forested streams. The study measured air and water temperatures at dozens of sites in each forest type. Figure 19 show the minimum, average and maximum water temperature of a Mattole River tributary, Dream Stream, in old growth mixed Douglas fir and redwood forest. The temperature range in these late seral conditions are between 10 and 14 degrees C, the optimal temperature for coho salmon. Any small forested stream with a complete late seral riparian canopy will show the same temperature range regardless of whether it is in interiro areas where summer air temperatures are warmer. Another example from the Redwood Sciences Lab study for second growth is Little Finley Creek, which ranged from (Figure 20). These temperatures are comparable to what PALCO claims are "normal" maximum temperatures in small forested streams (15.6 -21.1 degrees C). It is apparant the company has increased water temperatures through over-cutting of riparian zones.

- **"As the water in the mainstem of Yager passes through our property it is cooled by the water from our forest lands." (Vol. 2F, page 6 of 43).** PH-11

Yager Creek does cool somewhat on PALCO's property but not as much as it diod formerly. Extensive removal of riparian vegetation on the mainstem Yager Creek, Middle Fork and North Fork has left them more open to warming (see Riparian). Timber harvest in riparian zones of tributaries has also raised their temperatures and decreased their ability to buffer high mainstem temperatures. Until recently, Lawrence Creek also cooled on PALCO's property, but water temperatures in tributaries have increased and Lawrence Creek riparian cover has decreased, leading to warming. Figure 21 shows the water temperature of Lawrence Creek warms substantially from below Shaw Creek to its convergence with Yager Creek. Before recent timber harvests, tributaries of Lawrence Creek had a more moderating influence . While Bell and Corner Creek still contribute cool water (Figure 22), they are warmer than are forested streams with a complete canopies such as those studied by Redwood Sciences Lab. Timber harvesting in the Bell Creek riparian zone in 1998 may raise water temperatures further (Figure 23). In Shaw Creek,

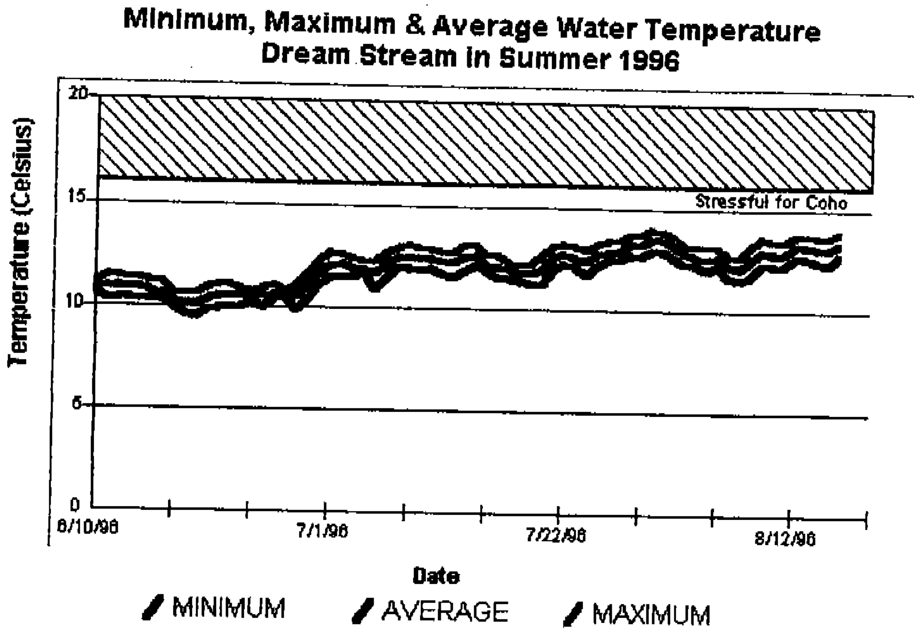


Figure 19. Dream Stream in the Mattole River watershed is one of several streams with a late seral canopy studied by Redwood Sciences Lab in Arcata. Note that temperatures range between 10 and 14 degrees C from June through August 1996. Graph from KRIS Coho.

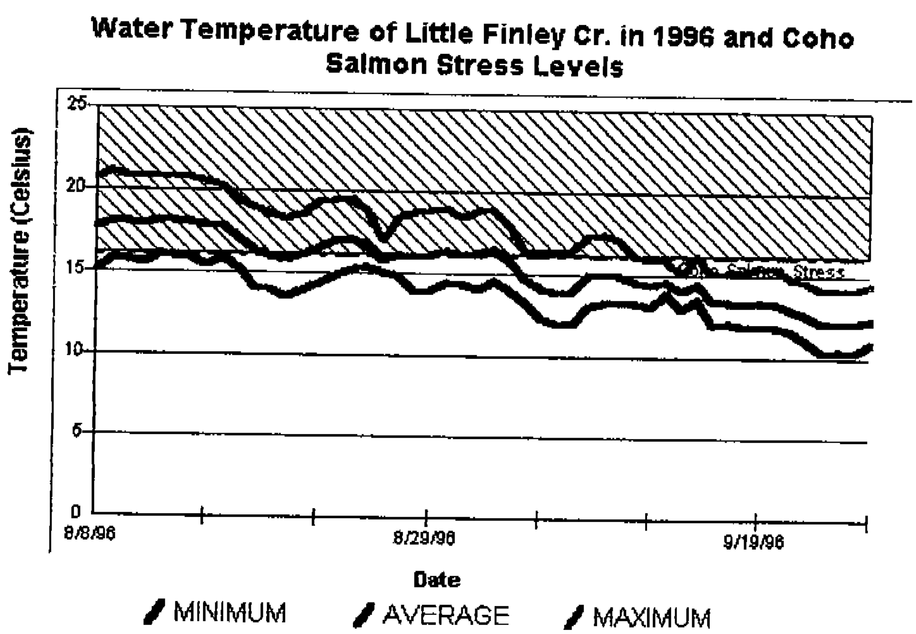


Figure 20. Little Finley Creek is a Mattole River tributary that represented second growth riparian conditions in the Redwood Sciences Lab study. Note that average water temperatures exceeded stressful levels during early August 1996. Graph from KRIS Coho.

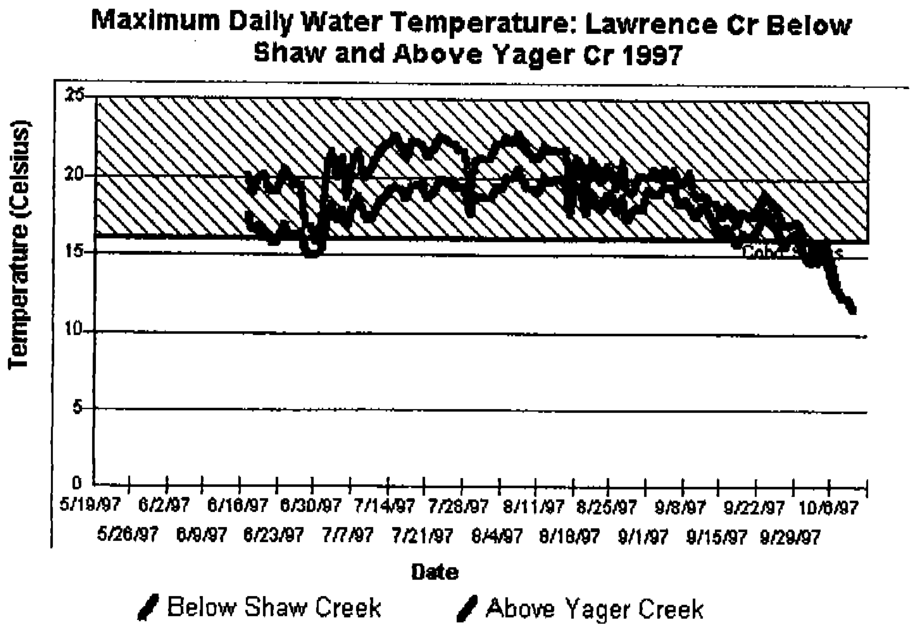


Figure 21. Lawrence Creek formerly cooled as it flowed from Shaw Creek to its convergence with Yager Creek, but as of 1997 the stream warmed in this reach. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

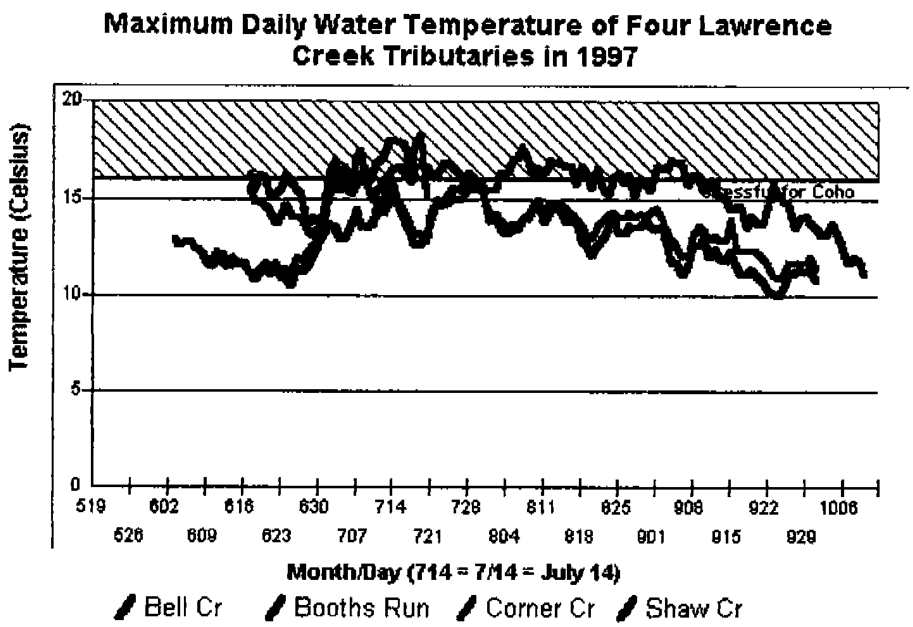


Figure 22. Booths Run Creek and Shaw Creek both exceeded stressful temperatures for salmonids in 1997. While Bell Creek and Corner Creeks still have a moderating influence on Lawrence Creek, timber harvests in riparian zones have diminished their buffering ability. Data provided by the Humboldt County Resource Conservation District. Graphic from KRIS Coho.

maximum water temperature exceeded stressful levels for coho consistently during the summer of 1997. Figure 24 is an aerial photograph of Corner Creek, which exemplifies riparian protection under California Forest Practice Rules. PH-11 CON.

- **"High water temperatures were present in the Yager Creek basin even under old-growth conditions, which supports observations by PL's foresters that stream temperatures in portions of the ownership isolated from cool ocean breezes are often high regardless of harvest history." (V2 67 of 132).** PH-12

The assertion in the HCP that Yager Creek and its tributaries were always naturally warm is false. Yager Creek had coho salmon juveniles and rainbow trout up to 12 inches near its convergence with the Van Duzen River in August 1964 (CDFG, 1964). The North Fork of Yager Creek had rainbow trout up to 14 inches when first surveyed in the summer of 1934 (CDFG, 1935). The large rainbow trout indicate that conditions were suitable for multiple year residence for juvenile steelhead and is indicative of cold water conditions.

- **"Within cool coastal climates temperature increases related to harvest are not as likely to produce stressful or lethal conditions as are increases in warmer climates that may already produce naturally high stream temperatures." (V4D 67 of 132).** PH-13

The PALCO HCP states that timber harvest in riparian zones in coastal climes will not cause problems with water temperatures. Howe Creek is in the coastal fog belt (Eel WAA) between Ferndale and Scotia and yet in 1997 the number of hours in the week that temperatures exceeded stressful limits for coho salmon were quite high (Figure 25). The problems in Howe Creek were probably exacerbated by high sediment loads similar to Bear and Jordan Creek. Surprisingly, the HCP reports a maximum water temperature of 22.7 degrees C for its station #14 in the lower Elk River in 1994. The average maximum temperature of 20.5 degrees C for the years 1994 through 1996 was also above stressful levels for coho. Thus, substantial problems are arising with regard to water temperature on PALCO's lands even in areas that have a marine climate.

Will the way in which the HCP deals with water temperature pose jeopardy under ESA?

The HCP does not recognize the true tolerance of coho salmon with regard to water temperature. PALCO was forced under the Agreement in Principal to "consider" the matrix of properly functioning habitat conditions (NMFS, 1997). However, the HCP does not accept the scientifically sound values put forth for temperature in the matrix. Instead the HCP states that the values are a "desirable future state that aquatic strategy will strive to achieve," but that the matrix "does not constitute enforcement standards that must be achieved during the life of the Plan" (V1 66 of 106). The lack of acceptance of scientific standards for temperature make the document fundamentally flawed. Without recognition of the true tolerance of coho salmon to warm water temperatures and enforceable standards under the HCP to reach conditions suitable for coho, actions under the Plan are likely to pose jeopardy to this species. PH-14

The HCP's lack of recognition of the dynamics of air temperature and water temperature lead to a number of false assertions and conclusions in the Plan. The lack of recognition of what drives water temperature creates substantial risk that riparian management under the HCP will cause jeopardy.

Figure 23. Timber harvest in the riparian zone of Bell Creek in 1998 may increase ambient air temperature over the stream which will in turn warm the water. Photo by Doug Thron.

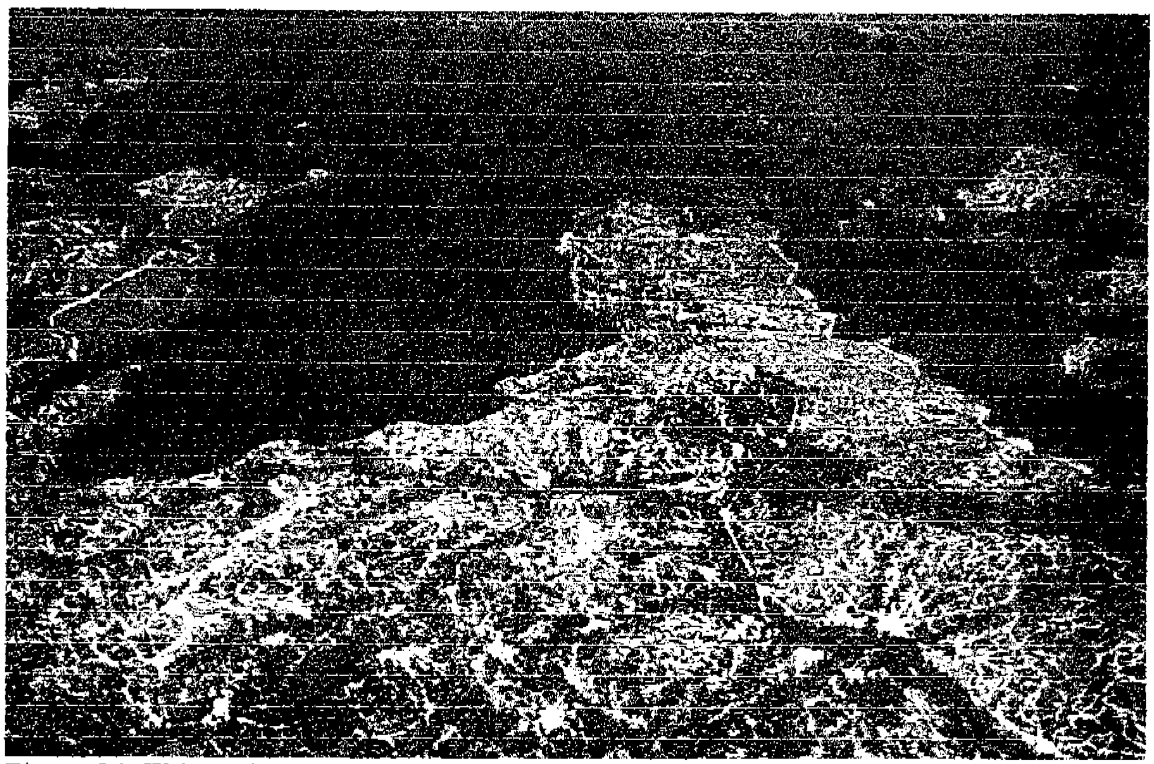


Figure 24. This aerial photograph shows Elk Head Springs Grove at the top and the Corner Creek watershed below. The timber harvests in this watershed have taken place since 1985 and riparian protections are according to California Forest Practice Rules.

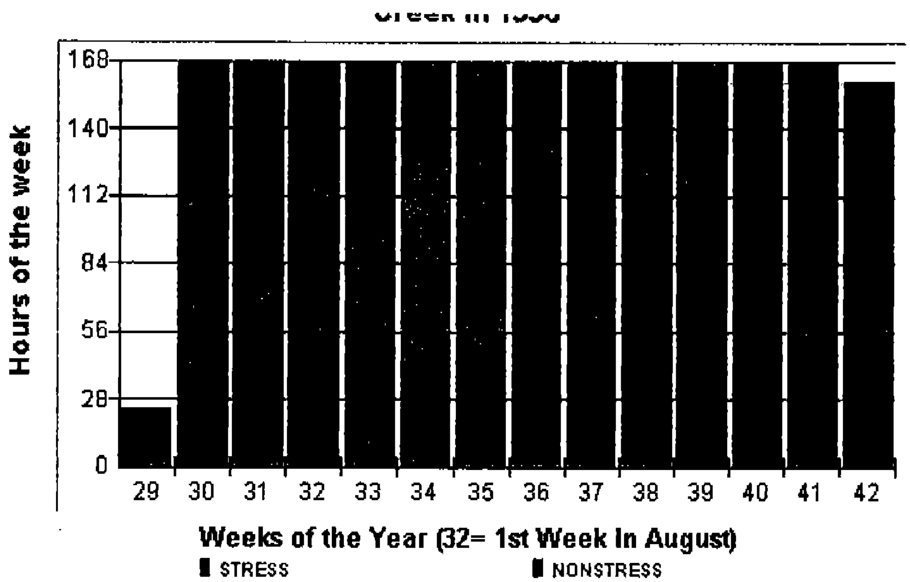


Figure 25. This graph shows the number of hours in the week that Howe Creek exceeded stressful temperatures for coho salmon (16 degrees C) in 1996. This amount of cumulative stress makes this stream uninhabitable for coho salmon despite the fact that the stream is located in an area influenced by fog. Data from the Humboldt County RCD. Graphic from KRIS Coho.

PALCO HCP and Sediment

Why is sediment an important issue in the PALCO HCP

Sediment is a very important consideration in the PALCO HCP because timber harvest activities can greatly increase sediment yield (PWA 1998) and sediment can negatively impact salmon, steelhead and cutthroat trout in a number of ways (Spence et al., 1996). Since salmon and trout bury their eggs in nests or redds, fine sediment may decrease survival through smothering of eggs or preventing emergence of fry. Fine sediment also decreases aquatic insect production as it fills interstitial spaces in the stream bed thereby reducing available food for salmonid juveniles. Large amounts of sediment may bury or scour riparian zones, widen channels and fill in pools. Loss of pools directly impacts juvenile coho salmon because they require pool habitat. The wider and shallower stream is also much more subject to heat exchange; consequently, high sediment contributions can exacerbate problems with stream warming.

Does the PALCO HCP present sufficient information on sediment issues to judge whether it meets biological and legal standards under ESA and NEPA?

PH-15

The PALCO HCP presents sufficient information on sediment related issues to demonstrate that it is likely to cause jeopardy to the future survival of coho salmon. In most of the WAA's, fine sediment levels in stream beds are already very high. The HCP will allow continuing timber harvest on steep, unstable slopes; a practice which caused catastrophic damage to some streams in recent years (PWA 1998a, 1998b). While 50 miles of roads will be improved per year under the HCP, hundreds of miles of roads will not be upgraded or maintained for decades. Therefore, risk of damage to streams will remain at unacceptably high levels and will likely lead to substantial losses of fish habitat. As with temperature, the HCP does not recognize actual levels of fine sediment that diminish sucess of coho spawning and egg survival. The HCP does not recognize fine sediment limits set in the NMFS matrix (1997) as enforceable standards.

PALCO HCP Assertions on Sediment in Relation to Scientific Literature and Other Available Data

- **"The percent fine sediment (< 0.85mm) is commonly believed to affect the ability of fish to spawn successfully. It has been reported that salmonid survival begins to decline when fines exceed 20% (Lisle and Eads, 1991). The exact relationship is not fully understood. There is a high degree of variability within monitoring stations, within streams, between streams and between years." (V2F 6 of 43)**

- **"Percent fines < 0.85mm were placed into three categories: 1) low (<20%), 2) moderate (20-30%), and 3) high (>30%). Support for the low category is provided by published studies that found percent fines in unmanaged streams in the Coast Ranges of Oregon and Washington of approximately 10-20 percent (Cederholm et al. 1981; Hatten 1991). In addition, data collected by PL indicate that values less than 20 percent are frequently**

observed in streams known to have high fish production (e.g., Lawrence Creek)." (V2H 15 of 42) PH-15

- **Humboldt Redwoods State Park tributaries, the South Fork of Yager Creek (in 1969) and Freshwater Creek are examples of places where fine sediment is "naturally" high. (V2F 6 of 43)**

- **"In 1996 we deleted 238 F&G sediment samples from the database on the advise of F&G. It was decided by F&G that by sampling the exact same spot each year and not the best spawning gravels in riffles, they had introduced a bias into the study. We threw out all but the first year's data." (V2F 6 of 43)**

The PALCO HCP, as in the case of water temperature, fails to acknowledge the best scientific information with regard to the impacts of fine sediment in stream beds on coho salmon. PALCO characterizes fine sediment < 0.85 mm as low if it is less than 20% but that value is not supported by the literature. PALCO considers the target goals of 11-16% fine sediment set forth in the NMFS matrix (1997) to be unachievable and not binding or enforceable during the life of the Plan. (V1 66 of 106)

Bjornn and Reiser (1991) suggest that fine sediment (<0.85 mm) in excess of 10% reduces salmonid egg and larvae survival considerably. Chapman (1988) summarized studies that indicated decreased survival of chinook and coho salmon between 10% and 20% fines. Cedarholm (1981) found that survival to emergence of coho salmon embryos was significantly reduced at fine sediment levels above 15%. In more recent field studies, Mc Henry et al. (1994) measured fine sediment inside coho salmon and steelhead redds in Olympic Peninsula streams and found that there was virtually no survival to emergence of eggs and larvae when fine sediment < 0.85 mm exceeded 13%. The State of Washington defines salmon spawning gravels as impaired when level of fine sediment (<0.85 mm) exceeds 11% (Washington Department of Fish and Wildlife, 1997). The U.S. EPA recently set a threshold of 14% for fine sediment (0.85 mm) for the Garcia River (EPA, 1998).

PALCO makes numerous references to streams with naturally high fine sediment but does not relate levels to stream gradient, geology or the timing of sampling. Klein (1997a) raised questions about PALCO's selection of data from Burns (1967) as an example of undistrubed streams. The South Fork Yager would be expected to have high fine sediment in 1967-69 because of effects of the 1964 flood, regardless of land use history. Klein (1997a) also questioned the selection of Godwood Creek by Burns (1970) noting that it had "an unusually gentle valley and channel gradients compared to other streams." Heppe (1997) questioned the use of Bull Creek and other Humboldt Redwood State Park tributaries as reference streams because insuffiient information was presented on historic land use, hydrologic events, geology and stream size.

PALCO characterizes Lawrence Creek as having fine sediment (< 0.85 mm) levels below 20% but still maintaining high fish production. This implies that fine sediment levels are near 20% as a natural phenomenon and yet fish production remains high. Actually, fine sediment levels in Lawrence Creek before recent disturbance by logging was near 10%. PALCO has data it did not include from a Winzler and Kelly (1981) report that showed very low fine sediment (< 0.85mm) levels in Lawrence Creek in 1980 and 1981. The average of all stations sampled in 1980 was 8.7% fine sediment and 10.3% in 1981. Thus, PALCO withheld information in the HCP that was relevant to the question of fine sediment thresholds. PH-15

CDFG resumed fine sediment monitoring in Lawrence Creek in 1991 and the trend in fines < 0.85 mm showed a steady increase through 1994 (Figure 26). PALCO routinely filed results of these fine sediment studies with timber harvest plans through 1995 (PALCO, 1995). After major storms in 1995, CDFG and PALCO decided to change protocols for sediment monitoring from a random selection of sites to choosing those sites that appeared to be good salmon spawning gravels. All results from 1992 through 1994 were discarded, although they had been collected using scientifically valid methods. In addition, instead of continuing to take several samples across a transect at each site, sampling methods were changed to include only a single sample taken from the deepest part of the active channel.

Klein (1997b), in a review of the PALCO HCP for the Environmental Protection Agency, noted that: "Data from 238 bulk samples collected by CDFG were deleted from their database because the samples were taken from the same place over time, rather than from the best spawning gravels in the monitoring reach. I would argue that sampling in the same place over time is far better than than only selecting the best areas. By moving the sampling sites around, they would be severely biasing their data in a way that would characterize the quality of substrate as better than it actually might be (p. 12)." In fact fine sediment < 0.85 mm decreased at virtually every sampling station after the change in methods (Figure 27). The decreased sediment levels came despite significant evidence that large quantities of sediment were contributed to Yager Creek during storm events in 1995 (Scanlon, 1995; Baker 1995).

- **"Percent fines <4.7 mm were placed into three categories: 1) low (<20%), 2) moderate (20-50%), and 3) high (>50%). Literature values to set these category limits were not identified, so a frequency distribution of levels in streams from the CDF&G database was prepared. This frequency distribution was then used to assess the category values, with the high category set to include approximately 30 percent of all observations." (V2H 14 of 42)** PH-16

PALCO chose 4.7 mm to define sand sized particles. Sand sized particles may intrude into a salmon nest and form an impermeable layer which prevents emergence of fry. The U.S. EPA defines sediment particles < 6.4 mm as sand sized for the Garcia River basin and set a threshold of 30% or less as a maximum (EPA, 1998). PALCO set its categories based solely on a frequency distribution of samples from its land, which include a number of impaired streams. Thus, the entire distribution scale is likely to be shifted upwards. Compared to healthy streams, PALCO's moderate levels of 20-50% may actually be high and the high levels (>50%) are likely to be lethal. In an earlier draft, PALCO set a target of <45% fines < 4.7 mm. Klein (1997b), in an analysis for the EPA, said of the 45% level of fines: "I can say this seems really high, something like cement. I suspect that riffle material with this much material <4.7 mm in diameter would have virtually no interstitial pore space within the gravel framework and would be very low in permeability (p. 16)."

- **"Two linear regressions (least squares methodology) were calculated to assess whether the intensity of management activities in each WAA could explain observed sediment values The** PH-17

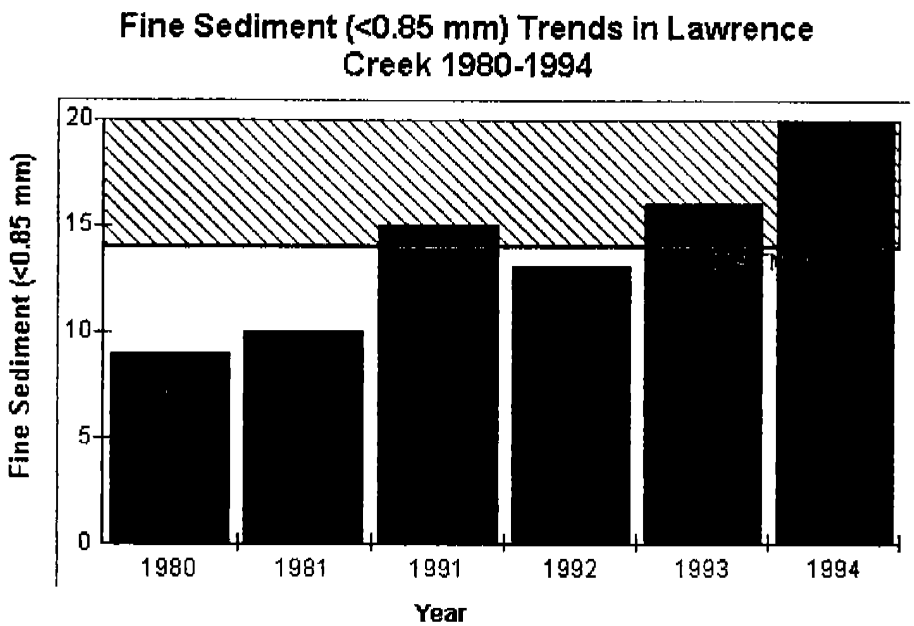


Figure 26. Fine sediment less than 0.85 mm more than doubled in Lawrence Creek when using average scores for all stations measured. Accelerated timber harvest began in 1985. Early data from Winzler and Kelly (1980-81) and recent data from the California Department of Fish and Game. Taken from THP 95-075 HUM filed by PALCO. Graph from KRIS Coho.

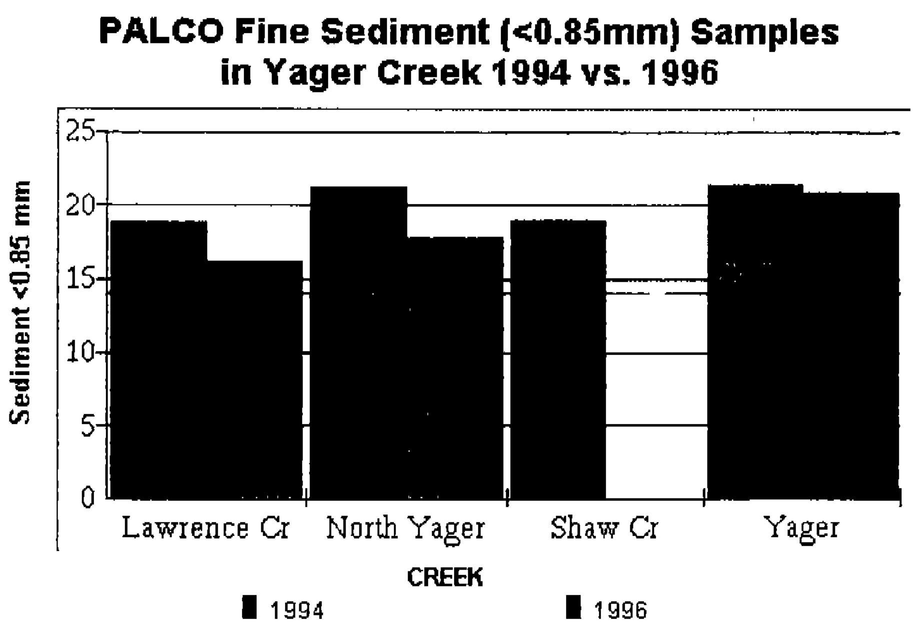


Figure 27. Fine sediment less than 0.85 mm decreased at every Yager Creek station measured by CDFG after protocols for sampling changed. This change is likely due to changes in methods, not actual decrease in fine sediment. Data from CDFG.

regressions indicated that the disturbance index and observed sediment levels were not correlated." (V2H 28 of 42)

PH-17 CON.

The lack of correlation found between management activities and observed sediment levels in the PALCO Watershed Analysis Areas may have been a function of the disturbance index and the homogenization of sediment values from all locations in each WAA. An anaylsis of the relationships between intensity of management activities on PALCO land and road densities, the amount of fine sediment in streams, and aquatic invertebrate biodiversity shows a clear correlation.

This analysis was done in KRIS Coho, using data on aquatic invertebrates, sediment and road densities that PALCO provided in the HCP, along with Landsat and aerial photography images. Conditions in the Little South Fork Elk River, which is just below the Headwaters Forest, were compared to conditions in the North Fork Elk River, which has been more intensely managed. Another analysis was conducted for the Yager Creek and Lawrence Creek areas, which are also intensively managed.

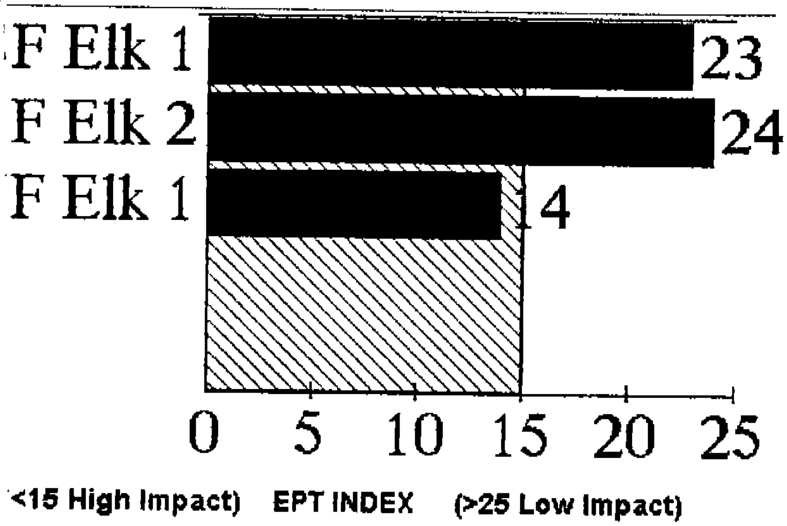
Landsat images were used to evaluate level of disturbance from logging. The imagery was acquired from Humboldt State University and had originally been classified using the California Wildlife Habitat Relationships protocol (Fox and Carlsen, 1996). A reclassification to ten vegetation and timber types was done by Dr. Paul Trichilo for the KRIS Coho project. For KRIS Coho analysis, CalWater planning watersheds, as defined by CDF, were used which is a finer scale than WAAs.

Aquatic invertebrates are not only good indicators of aquatic health but also an important food resource for salmonids. Therefore, a reduction in insects would be expected to reduce the carrying capacity for juvenile coho salmon. The number of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) , also known as the EPT Index, is an indication of stream health. The species of these orders are all pollution intolerant so high species richness within these orders (EPT index greater than 25) indicates an intact watershed, and fewer than 15 taxa indicate high disturbance (EPT index less than 15). These thresholds are after Plafkin et al (1989).

Table 2. A summary of the analysis of relationship between management activities, EPT index, fine sediment and road density for two streams in the same WAA.

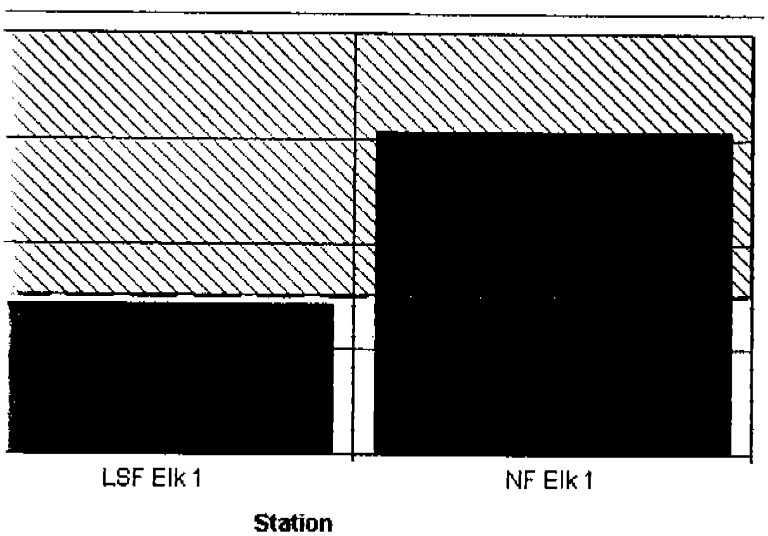
Little South Fork River Monitoring Stations 13 & 23	**North Fork Elk River Monitoring station 14 (on lower N.F.)**	**Figures**
EPT index = 23 & 24 (low impact)	EPT index = 14 (indicates high impact)	Fig. 28
Fine sediment < 30%	Fine sediment > 60%	Fig. 29
Road density = 1.4 mi / square mile	Road density > 5mi / square mile	Fig. 30
Landsat: Shows mostly undisturbed vegetation, mainly large trees	Landsat: Shows extreme disturbance in upper reaches.	Figs. 31 & 32
	Aerial photograph: Shows clearcut in upper N.F., and no protection for a Class III stream.	Fig. 33

Sampling Stations



e EPT Index is the number of taxa of mayflies, stoneflies and caddisflies, all ely intolerant to pollution. Low number of taxa in the North Fork Elk (<15) ershed disturbance while high diversity in the Little South Fork indicates hed health. Data from PALCO HCP. Graph from KRIS Coho.

›diment <4.7 mm from McNeil Samples in Elk River on PALCO Lands



e sediment less than 6.4 mm for the lower North Fork Elk River monitoring er 60 % while the Little South Fork had fines under 30%. The latter value reshold for fines less than 6.5 mm by the EPA for the Garcia River. Data HCP. Graph from KRIS Coho.

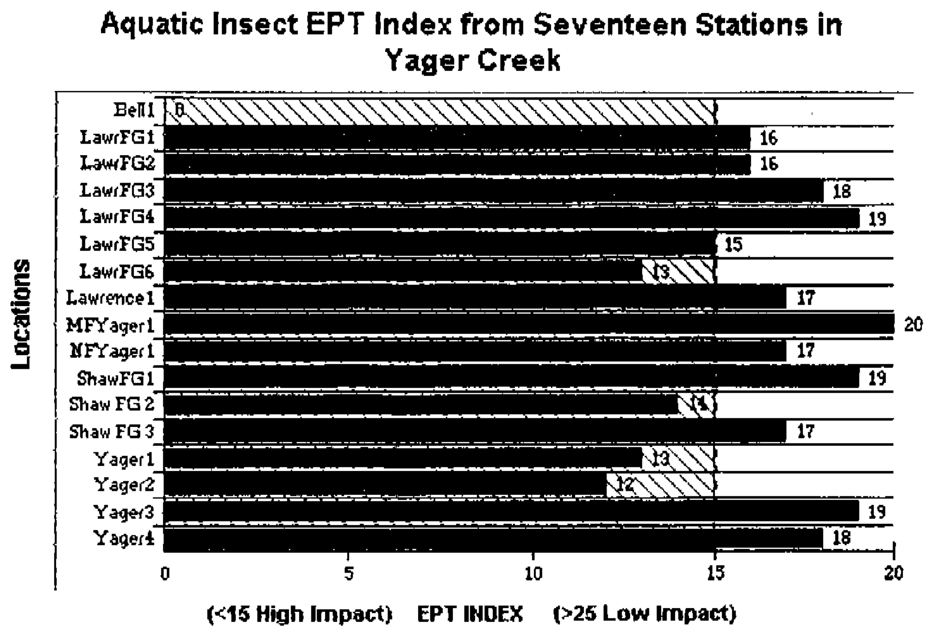


Figure 34. The EPT Index shows depressed numbers of these sensitive aquatic insect taxa at several locations, indicating a highly impacted aquatic ecosystem. None of the stations rate a healthy score of more than 25 taxa. Data from the PALCO HCP. Graph from KRIS Coho.

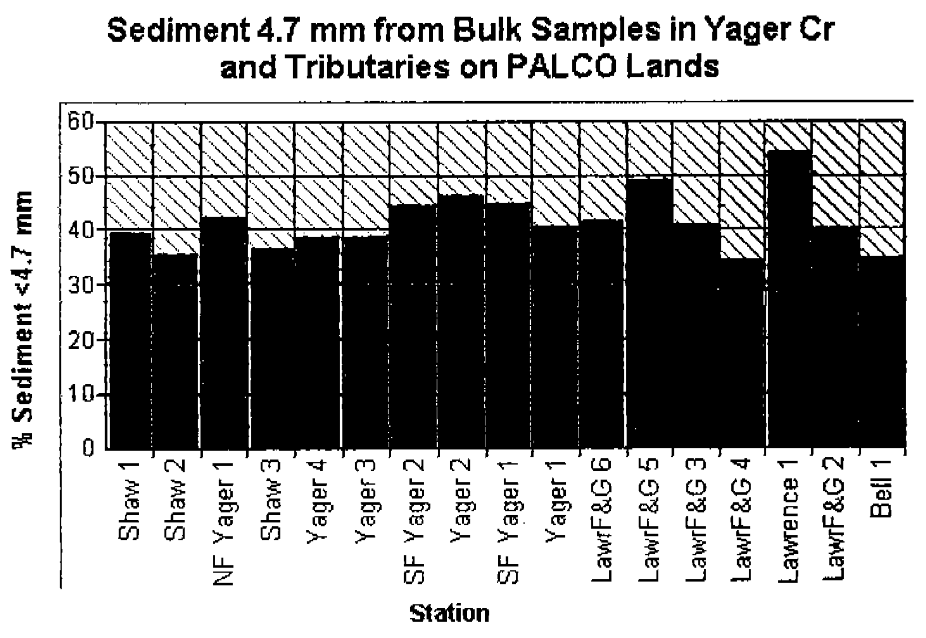


Figure 35. The level of fine sediment in sand-sized classes (<4.7 mm) in the Yager and Lawrence Creek basins is very high, with 10 of 17 stations showing levels greater than 40%. High fine sediment in stream gravels is most likely related to the depressed aquatic insect scores in Figure 34 as well. Data from the PALCP HCP. Graph from KRIS Coho.

Vegetation and timber types for the Side 8 Calwater planning watershed, which includes Corner Creek, are shown in Figure 38. The histogram of vegetation and timber types for this area shows that a large number of acres are comprised of shrubs. The 1994 Landsat image of the same Calwater Side 8 unit shows the widespread nature of disturbance in the entire Lawrence Creek watershed on PALCO lands (Figure 39). Given this level of disturbance, it is not surrising to see aquatic insect and fine sediment levels that are indicative of poor watershed health. PH-17 con.

- **"A recent report on Bear Creek (PWA 1998b) indicates that the rate of large failures in this watershed is similar to levels under unmanaged conditions, but that management has increased the incidence of small landslides and overall sediment loading rates." (V2H 35 of 42).** PH-18

- **"On PL's ownership for example, some areas appear to be especially prone to post-harvest mass wasting. However, two recent studies on PL's lands (PWA 1998A, 1998B) indicate that many landslides can occur even when no harvest has taken place."**

- **"Data to document the role of management in sediment loading is especially important so that PL can prevent being held responsible for impacts that are mostly natural in origin." (V2H 35 of 42).**

Pacific Watershed Associates (1998b) noted that 85% of the sediment contributed to the channel of Bear Creek came from 37% of the landscape that had been disturbed by logging in the last 15 years. Debris slides on clear cuts, not road failures, were the main source of sediment (Figure 40). The sediment flowed as a debris torrent down the entire length of the stream channel to its convergence with the Eel River. PWA (1998b) noted that lack of large wood in the torrent was responsible for the extended length of damage to the stream channel. Large wood would typically catch sediment at various locations as logs held up in jams. The amount of sediment yield was calculated as five times over background levels, and the stream channel was buried from five to eight feet deep (PWA, 1998b). Sediment problems have become acute in Bear Creek, with pools filled, fine sediment levels elevated and channel width increased. Figure 41 shows the edge of the channel of Bear Creek and an adjacent terrace of sediment in January 1997. As noted above, water temperatures in Bear Creek have become lethal to coho salmon. In the Elk River Basin, Reid (1998b) estimated that landslide rates were over 13 times greater on logged lands than on uncut portions of the watershed or older harvest units.

- **PALCO will "likely" assess road networks and sediment sources under the ITP within a few years but only commits to a three decade schedule: Elk River, Freshwater, Lawrence and Yager creeks in the first decade; Van Duzen and Eel WAA's will be assessed in the second decade; and Larabee Creek , Salmon Creek and the Bear/Mattole WAA in the third decade. (V4D 32 of 132)** PH-19

- **PL has proposed several Plan measures that specifically address road related impacts: 1) continuation of a program to storm-proof existing roads at a rate of at least 500 miles/decade, 2) all new roads will be built to storm-proof specifications, 3) all storm-proof**

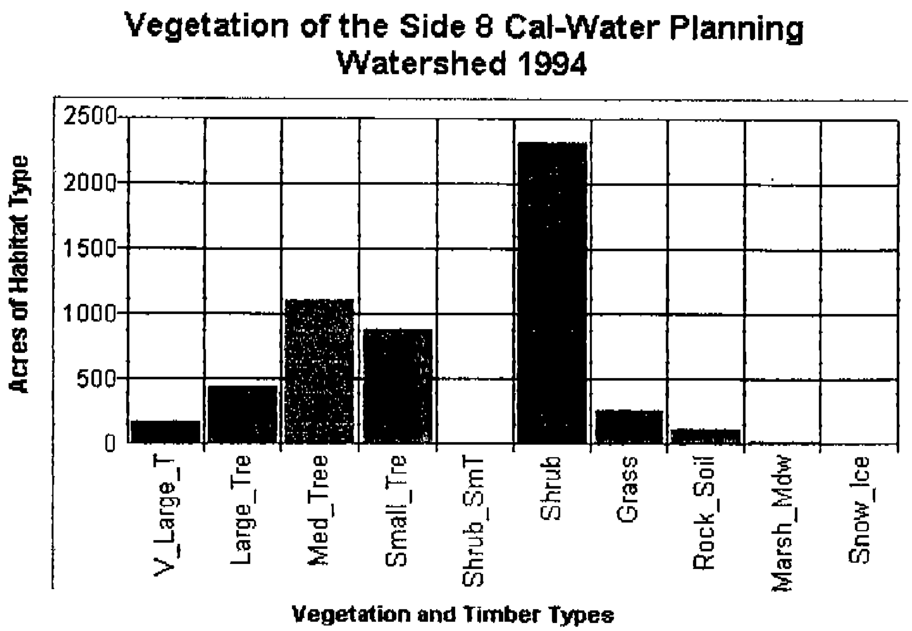


Figure 38. This bar graph of vegetation and timber types in the Side 8 Calwater planning watershed shows a high shrub component as a result of recent timber harvest. Data derived from 1994 Landsat image classified from HSU. Graph from KRIS Coho.

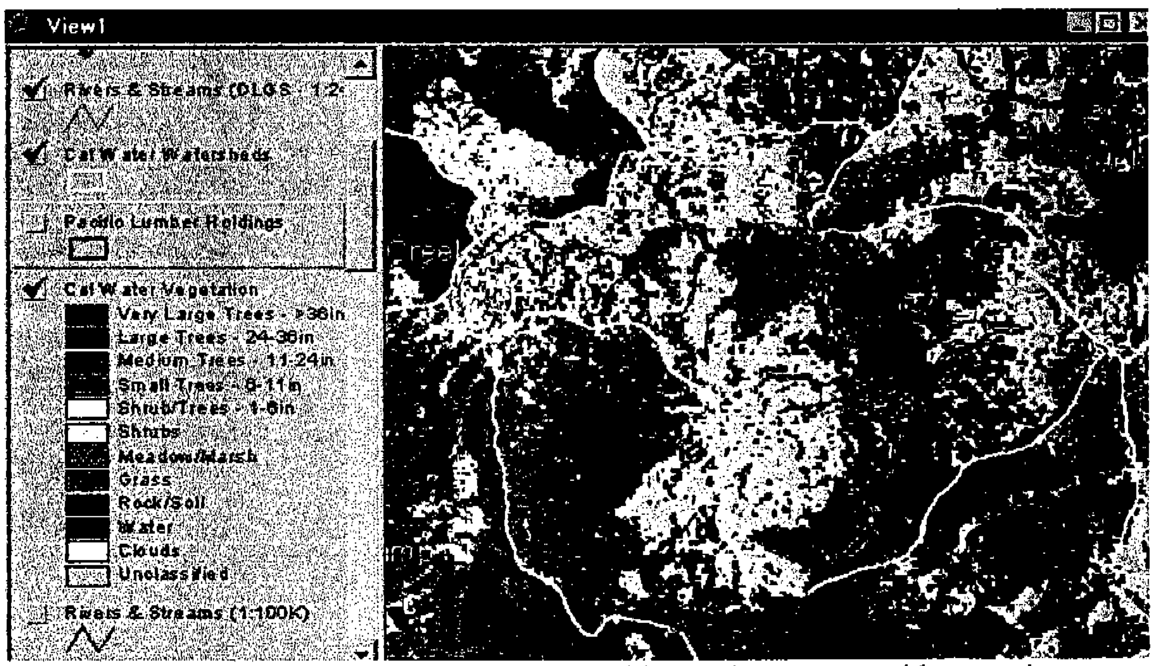


Figure 39. This 1994 Landsat image shows the Side 8 Calwater area with extensive disturbance related to recent timber harvest. Corner Creek (Fig 37) is at the upper left of this image. Lawrence Creek flows down the middle of the Side 8 planning area. With this much of the watershed area disturbed, high fine sediment scores in streams is not surprising. Landsat image from HSU and KRIS Coho MAP project.

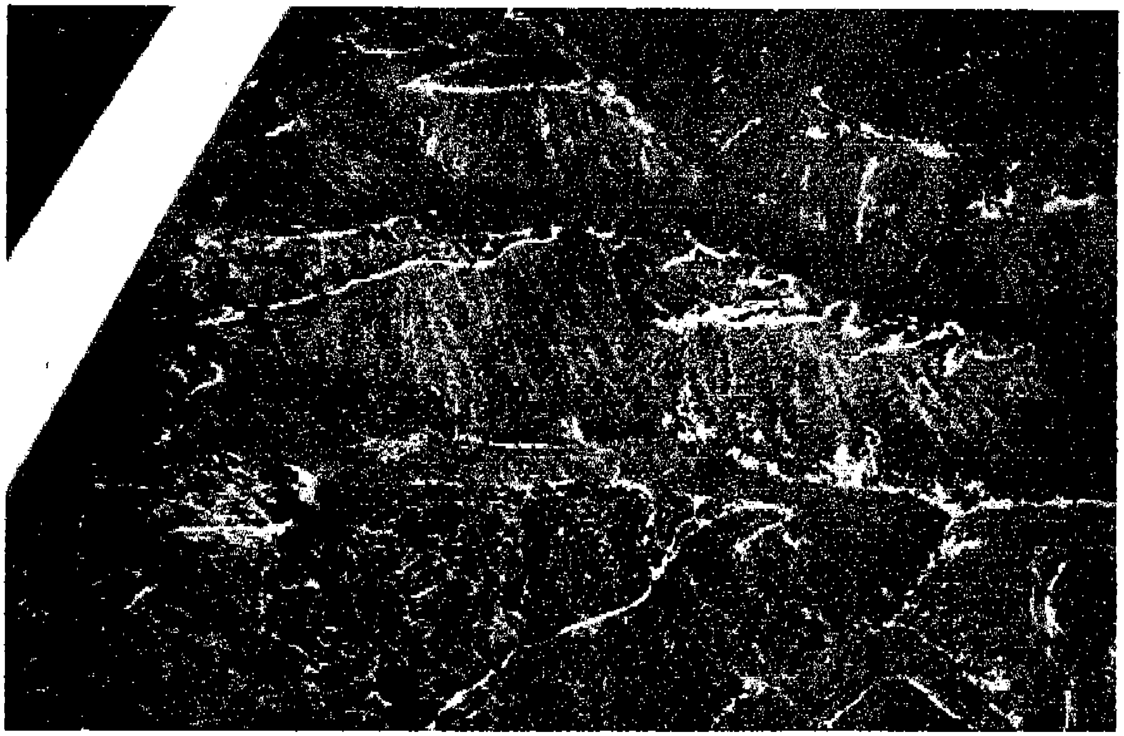


Figure 40. This aerial photo of the Bear Creek watershed was taken during summer of 1997. Debris slides and scoured stream channels are evident. Photo by Richard Geinger.

Figure 41. This photo shows Bear Creek in Humboldt Redwoods State Park with fine sediment deposited behind large redwood trees in the riparian zone. The sediment deposit still remaining in the stream is several feet deep as a result of the January 1, 1997 storm. Photo courtesy of and copyright by Doug Thron.

roads will be maintained to the storm-proof standard, 4) THP related roads will be upgraded as needed to provide for adequate road drainage and erosion control, 5) all THP related roads will be inspected at least annually for three years after operations, 6) all open roads will be inspected at least yearly, 7) any maintenance needs identified by inspections will be performed by the end of the field season following the inspection, and 8) road use and construction will be limited during periods of precipitation. (V4D 32 of 132) PH-19 con.

The HCP presents data that indicate road densities are already over 3 miles per square mile in almost every WAA, a threshold over which negative impacts to salmon spawning occur (Cedarholm, 1981). However, HCP makes no proposal to reduce road densities.

The schedule of road assessment set forth in the HCP may ultimately leave the Bear/Mattole WAA and other areas uninventoried for three decades. The road upgrading strategy calls for 50 miles of road storm-proofing per year with a total of 500 miles per decade. Annual road improvement goals will include upgrading old roads associated with timber harvest. PALCO has 2000 miles of roads on its property and there will not necessarily be any net reduction in their road system. Spence et al. (1996) calls for road removal in sensitive locations such as stream side zones and at locations likely to trigger landslides. PALCO makes no committment to remove roads in riparian zones over the course of the Plan, although there are hundreds of miles of roads parallel to streams on the company's land that pose threats of chronic erosion. Potential for massive soil loss due to road failures during large storm events is possible every year.

Although the road upgrading program is commendable, there are several loop holes that will allow erosion risk to remain high. Those roads no longer considered active (open) may be "abandoned" but not removed or decommissioned. Road inspections are only mandated for three years after timber harvests, similar to existing CFPR. Therefore, PALCO will have hundreds of miles of roads that have no fixed maintenance schedule and which will be subject to catastrophic failure during large storm events for the life of the Plan.

- **The professional registered PL geologist shall assess the influence of the proposed operation on the risk of hillslope failure. In areas where the potential for mass wasting is rated as "very high" or "high", PL will not operate heavy equipment off of existing roads or construct new roads, without a geologist's report recommending alternative prescriptions that are approved by CDF. (V4D 43 of 132)** PH-20

- **If the notified agencies have concerns regarding the harvest proposal related to the risk of mass wasting, they may communicate such concerns to the RPF and CDF within 30 days of receipt of materials from PALCO or until the close of the public comment period, whichever is longer. As mandated under the FPA, CDF, as lead agency for THP review, will consider all input and determine whether the mass wasting mitigation measures contained in the THP will avoid significant impacts.**

Landslide risk in some of PALCO's holdings such as the Bear/Mattole WAA and the Eel River WAA is very high. Timber harvests on steep inner gorge slopes in the North Fork Mattole River watershed have triggered landslides in recent years (Figure 42) and normal review processes under CDF have failed to prevent significant soil loss and damage to streams. The process put

Figure 42. This aerial photograph of the North Fork Mattole River shows problems related to inner gorge failure on steep slopes after timber harvest. Sediment from landslides in the inner gorge is directly contributed to streams.

Figure 43. This aerial photo shows the Stafford slide. Allowance of timber harvest on such steep, unstable slopes under CFPR has caused widespread mass wasting problems.

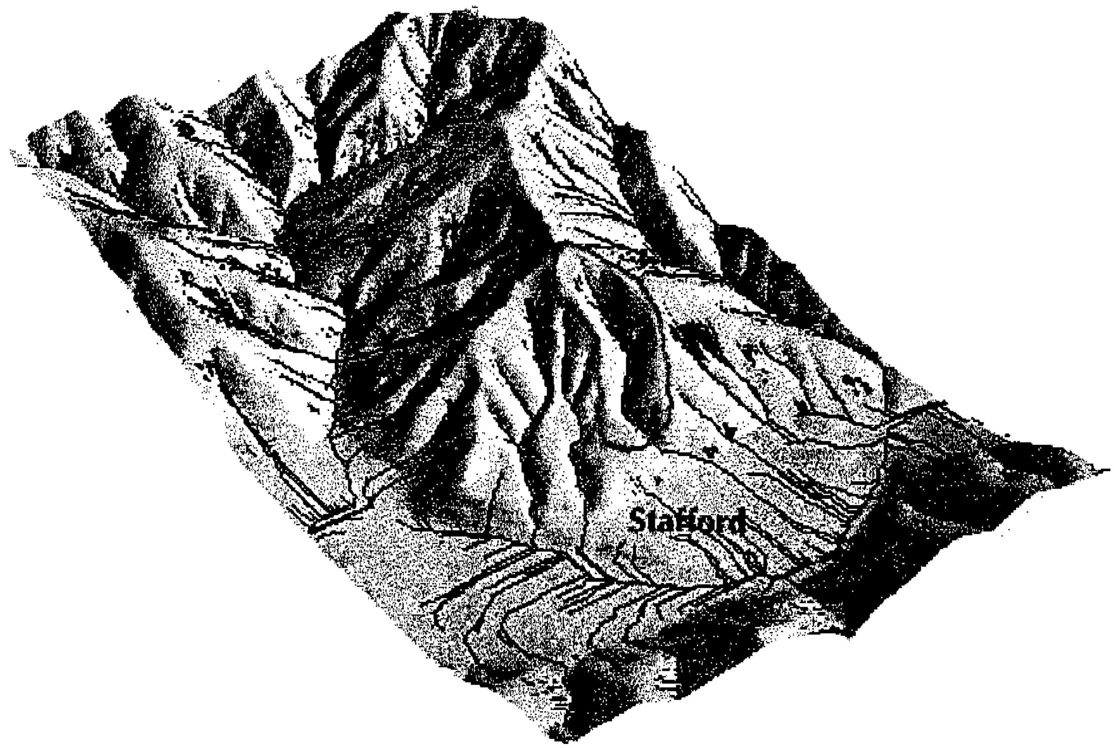


Figure 44. This three dimensional model was generated in ArcView using the Dietrich and Montgomery landslide model. Green is high risk of slope failure and dark green is extreme risk. Graphic from KRIS Coho MAP.

Figure 45. Shows where landslides are predicted by Deitrich and Montgomery model versus where actual debris slides have occurred (from Tom Spittler CDMG).

forth under the HCP is essentially the same process that has failed. The Northcoast Regional Water Quality Control Board has expressed reservations about the HCP "mass wasting avoidance strategy" and instead has suggested that very steep and unstable hillslopes need to be kept vegetated (Michilin, 1998). PH-20 CON.

Extensive landsliding in the Eel WAA on recently logged land also points to a pattern of failure with regard to prevention of landslides under CFPR. One such landslide, partially on PALCO land, occurred above the town of Stafford (Figure 43). The KRIS Coho MAP project used the Dietrich and Montgomery (1996) landslide model in the program ArcView to analyze the pattern of debris sliding in the Stafford Quadrangle. The model combines concentration of water flow and steepness of slope to predict where debris slides are likely to occur (Figure 44). When compared to known active landslides as mapped by the California Divisions of Mines and Geology (Spittler, 1998), a clear relationship exists between where debris slides are predicted and where they have occurred (Figure 45). The HCP clearly fails to use the best commercial and scientific information available in terms of screening areas for landslide risk.

<u>Does the way the PALCO HCP deals with sediment issues pose problems with compliance with ESA and CEQA?</u> PH-21

The PALCO HCP fails to recognize the level of fine sediment required for healthy salmon spawning and refuses to set targets for fine sediment in streams or to agree to enforceable standards. Therefore, there is no assurance that levels of fine sediment appropriate for salmon production will be achieved under the life of the Plan. Fine sediment in streams is already at extremely high levles on PALCO property and the HCP will cause additional inputs. Therefore, actions under the HCP are likely to reduce the liklihood of coho salmon survival and recovery in the wild. The company ignored its own relevant sediment data from Lawrence Creek from 1980-81 and, in violation of scientific protocols, excluded data from CDFG from 1992-1994. This demonstrates that the company has breached trust in this process.

Actions that the company proposes under the HCP will trigger additional sediment input to streams will certainly pose jeopardy. The "mass wasting avoidance strategy"defaults back to the CDF as the lead agency despite patent failure on the part of this agency to prevent landslides on steep unstable lands in the past (Michilin, 1998). PALCO fails to meet the standard of using the best available scientific and commercial data by not using debris slide models recently developed (Montgomery and Deitrich, 1994) which could help to detect areas of the landscape that are too unstable to disturb. Landslides on steep, inner gorge aras are likely to cause destruction or adverse modification of critical habitat.

The extremely high level of fine sediment in PALCO streams is linked to high road densities. Under the HCP, PALCO makes no commitment to road relocation or a target for road reduction. It is likely that huge amounts of sediment will be contributed to streams from episodic road failures during large storm events, despite the road upgrading committed to under the HCP. Therefore, the HCP has not mitigated for this impact to the extent practicable and their actions under the Plan are likely to pose jeopardy.

PALCO HCP AND RIPARIAN ZONES

1. The riparian zone is the interface between the aquatic and terrestrial ecosystems. It is the area of vegetation extending back from a stream. A riparian zone is very important to a stream ecosystem function, fishes and some wildlife species because of the following functions (Spence et al., 1996; Reed, 1998):

- Helps maintain cool water temperatures through provision of shade and creation of a cool and humid microclimate over the stream,
- Provides food resources for the aquatic ecosystem in the form of leaves, branches, and terrestrial insects
- Stabilizes banks through provision of root cohesion on banks and floodplains
- Filters sediment from upslope sources
- Filters chemicals and nutrients from upslope sources
- Supplies large wood to the channel which maintains channel form and improves in-stream habitat complexity
- Helps maintain channel form and in-stream habitat through restriction of sediment input or slowing sediment moving through the system
- Moderates downstream flood peaks through temporary upstream storage of water

The riparian discussions in the HCP all refer to streams in the convention of the California Forest Practice Rules. The definitions of stream classes are as follows:

- Class I watercourses always or seasonally have fish present and include habitat to sustain fish migration and spawning; or are within 100ì of a downstream domestic water supply.
- Class II watercourses have habitat for nonfish aquatic species and/or are within 1,000ì of a downstream watercourse where fish always or seasonally are present.
- Class III streams do not have aquatic life present in them but show evidence of being capable of sediment transport to Class I or II waters under normal high flow conditions after completion of timber operations.

<u>Does the HCP provide sufficient information regarding riparian protection to judge whether it complies with ESA and CEQA requirements?</u> PH-22

There is enough information provided in the HCP regarding riparian protection strategies to show clearly that the Plan will fail to sufficiently protect these areas enough to protect and retore coho salmon. There is no fixed formula for riparian protection in the HCP, rather riparian zones will remain negotiable as part of watershed analysis and PALCO may petition for a change in riparian harvest restrictions if another company's HCP allows more liberal standards. However, even if riparian protections remain at maximum levels put forth in the HCP, they are likely to cause further increases in stream temperatures, reduced recruitment of large wood to streams and loss of sensitive amphibian species such as the tailed frog. Lack of any protection for headwater streams (Class III) from timber harvest alone makes it likely that the HCP will cause jeopardy to coho salmon. The HCP fails to present a scientific basis to judge whether the interim riparian standards are sufficient and thus fails to use the best commercial and scientific information available.

PH-23

<u>PALCO HCP Assertions on Riparian Issues in Relation to Scientific Literature and Other Avaliable Data</u>

- **"Class I streams as defined in the CFPRs will have a Riparian Management Zone (RMZ). The RMZ will measure 170 ft (slope distance) from the watercourse transition line as defined in the CFPRs or CMZ edge (if a CMZ is present), on each side of the watercourse. The RMZ for Class I streams is divided into three management bands, the Restricted Harvest Band (RHB), the Limited Entry Band (LEB) and the Outer Band (OB). The bands are measured 0 ft to 30 ft, 30 ft to 100 ft, and 100 ft to 170 ft from the watercourse transition line as defined in the CFPRs or CMZ edge (if a CMZ is present), respectively." The LEB must have 345 sq. ft. of basal area to allow harvest and must retain 300 sq. ft. post harvest while the OB must have 276 ft. mbefore harvest is allowed and 240 sq.ft. basal area must be retained. No more than 40% of basal area may be harvested in either zone. (V1 65 of 106)**

Note: The RHB may extend to 100 ft. on Class I streams due to final negotiation with California Legislature, although there is nothing in the Plan that confirms this.

The PALCO HCP set riparian harvest levels through negotiation with agencies such as NMFS, CDF, USFWS and CDFG. Under the HCP, substantial timber harvest will be allowed in the 170 foot wide Riparian Management Zone (RMZ) of Class I streams. This strategy departs substantially from the Forest Ecosystem Management Assessment Team (FEMAT, 1993) approach for protection of stream side zones. FEMAT, also referred to in the HCP as the Northwest Forest Plan, is the best attempt by Federal fisheries, wildlife and earth scientists from throughout the Pacific Northwest to define protections necessary to prevent the extinction of Pacific salmon and to maintain other sensitive species such as amphibians. The HCP also does not cite or recognize <u>An Ecosystem Approach to Salmonid Conservation</u> (Spence et al., 1996), a comprehensive study funded NMFS, EPA and USFWS to guide agency staff and others in shaping HCP's.

Riparian protection on Class I and Class II streams on federal land includes two site potential tree heights. This would be twice the average height of the riparian trees, extending in both directions from the channel. On steep streamside areas known as inner gorges, protections may extend up hill to the break in slope. Spence et al. (1996) reviewed forest practice rules for all western states and cited deficiencies with regard to riparian protection. The report concluded, after an exhaustive review of the literature, that one site potential tree height was absolutely critical as a riparian zone to protect the cool microclimate over the stream and thereby prevent a further increase in water temperature. The HCP provides no data to demonstrate the effectiveness of the riparian strategy offered to protect coho salmon and other species.

A critical difference between the HCP and FEMAT (1993) is the lack of recognition and protection of inner gorge areas. Experience from Federal lands throughout the Pacific Northwest indicated that steep slopes immediately adjacent to streams posed the greatest risk of increased sediment yield. No timber harvest can take place within the inner gorge, regardless of the linear distance from the stream because landslides are likely to be triggered and sediment directly contributed to streams (FEMAT, 1993). There is no provision within the HCP to prevent timber harvest in these extremely sensitive areas other than the same process of review under CDF which has failed heretofore (Michlin, 1998). PALCO has been actively harvesting these areas and some of the logged areas have already caused catastrophic damage to streams like Jordan Creek (Figure 46). The HCP calls for timber harvest in inner gorge locations in the North Fork Mattole River, despite the fact that recent harvests have caused considerable soil loss and degradation of aquatic resources there (Figure 47). Reid (1998b) found that in Bear Creek , 69% of landslides that contributed sediment to the stream were in inner gorge locations.

PH-23 CON.

The stream side protection zone for Class I streams in the HCP is arbitrarily set at 170 feet with no scientific justification offered. The buffer width recommended seems to mimic buffers from Oregon and Washington, where site potential tree height is less. Spence et al. (I 996) note that increased site potential in the redwood region necessitate riparian buffers greater than 200 feet to insure large wood recruitment. Site potential on PALCO holdings may be 250 feet or more in some locations. Spence et al. (I996) also note that larger pieces of wood are very important to fish habitat formation. Allowing logging of large conifers within one site potential tree height would decrease recruitment of these "key pieces" of wood, which can remain in streams for 100 years or more.

Air temperatures are also much warmer in California and, therefore, greater protection of riparian zones is necessary to provide a buffering influence. The HCP does not take into account that water temperatures on many PALCO streams are already outside the range of tolerance for coho salmon and the natural range of variability (see Temperature). Stream temperature problems on PALCO land are compounded by aggradation caused by elevated sediment yield from management related disturbances. Because these streams are wide and shallow, they are subject to greater influence of heat exchange with the air (Spence et al. 1996). Any increase in ambient air temperature above impaired streams, even from heat transfer due to logging further back in the LHB, OB or areas out to two tree heights, will further increase water temperatures.

The current condition of PALCO's riparian zones were also not factored into decisions by the company and agencies during formulation of the HCP. There have been substantial declines in riparian stands on PALCO lands since the Maxxam take over in 1986. Figure 28a shows the decrease in direct shade related to logging in riparian zones between 1980 and 1991and Figure 28b shows extent of timber harvest in the riparian zone of Shaw Creek. The intensive timber harvests in recent years make it critical to maintain existing riparian function because of the degraded existing conditions.

Spence et al. (1996) make the case that you must not only provide protection for the immediate riparian zone but also a buffer if proper function is to be maintained. Even if a complete one site potential tree height buffer is maintained, windthrow and blowdown during winter storms can substantially disrupt riparian function and alter microclimates. If clear cutting takes place up to 170 feet under the HCP, major blow down within the RMZ can be expected.

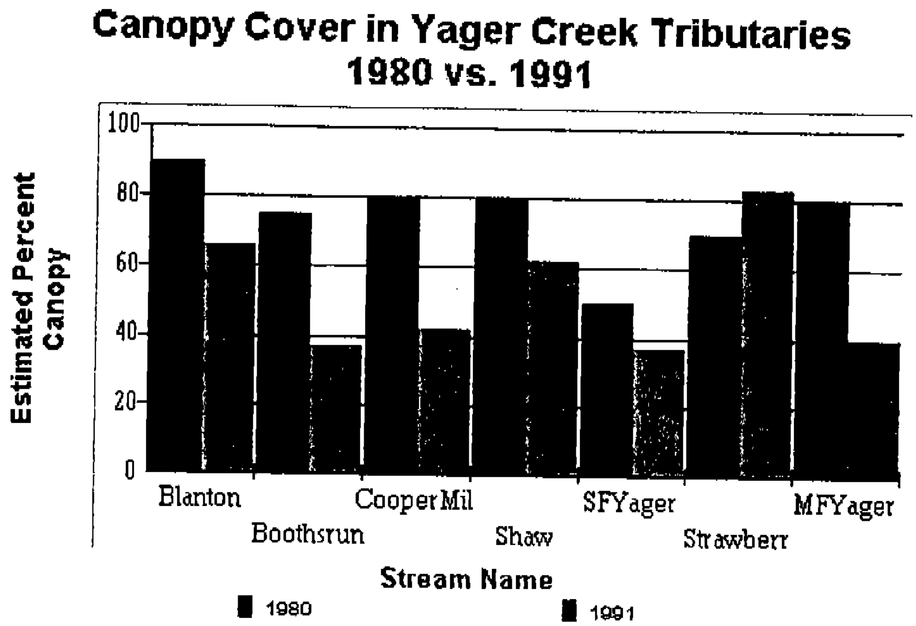


Figure 28a. This chart shows changes in riparian conditions in Yager Creek sub-basins between 1980 and 1991 according to CDFG surveys. Data from CDFG. Graph from KRIS Coho.

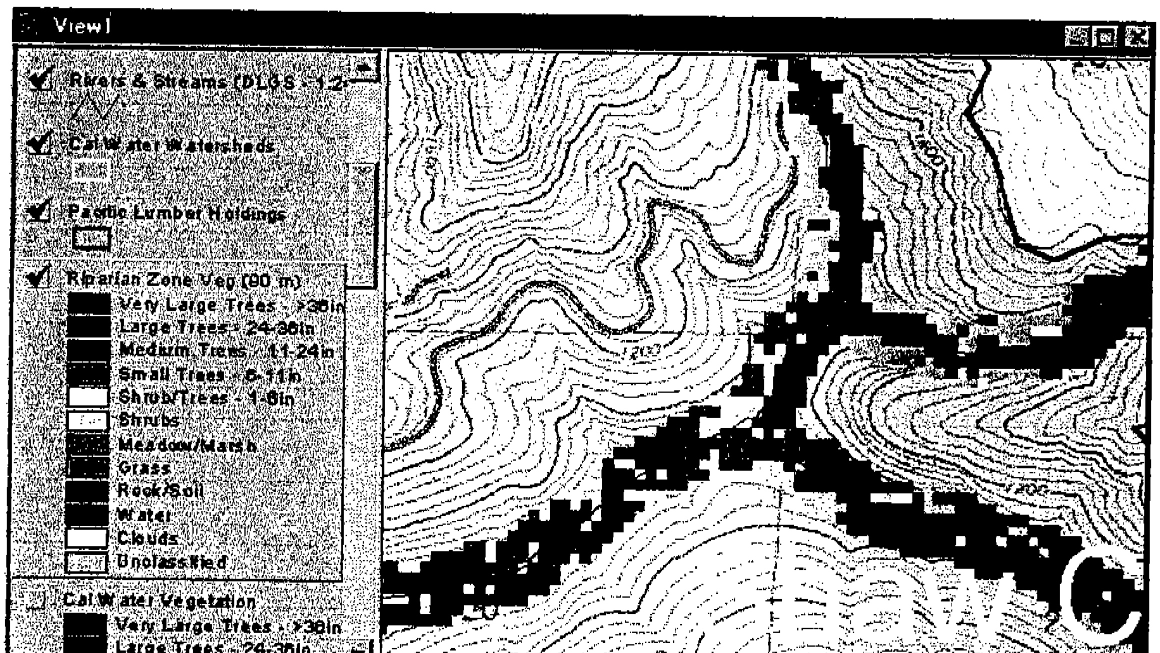


Figure 28b. This ArcView image from KRIS Coho maps shows the riparian zone of Shaw Creek and confirms that extensive timber harvest has taken place in the riparian, thus reducing availability of large wood for recruitment to the stream. Taken from HSU and KRIS Coho MAP project.

Figure 46. This aerial photograph of Jordan Creek shows an inner gorge failure that contributed many tons of sediment directly to the stream in January 1997. The PALCO HCP allows continuing timber harvest in inner gorges.

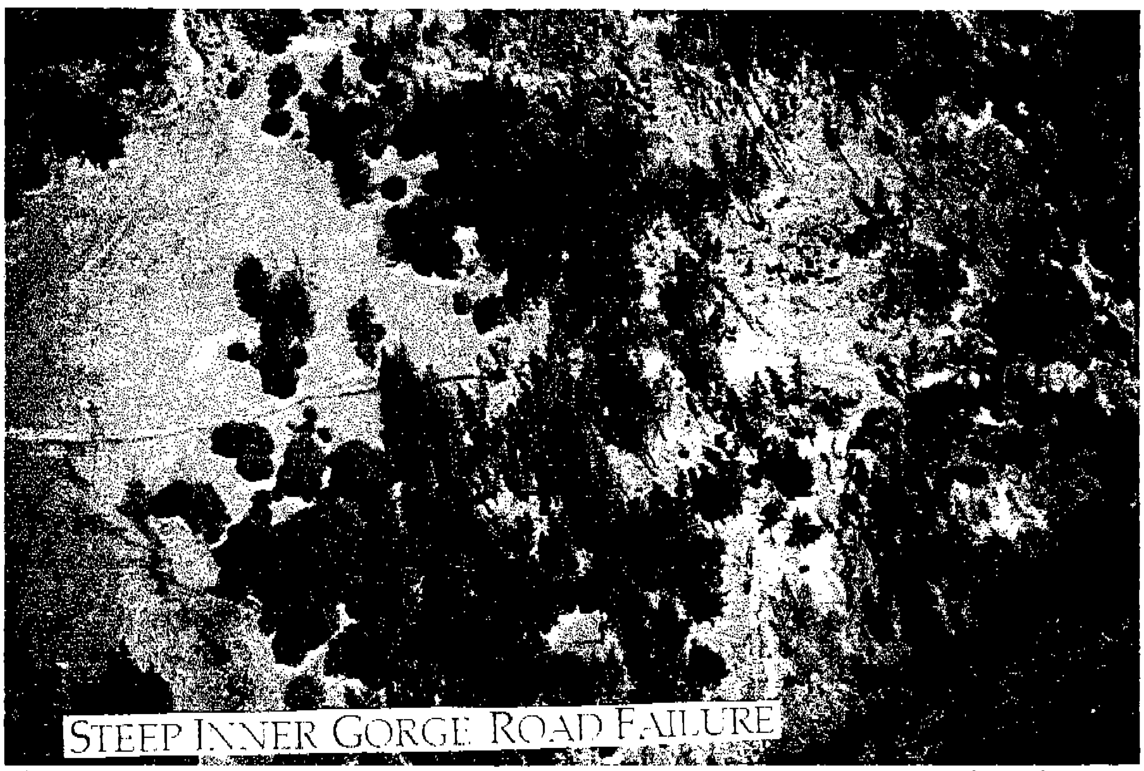


Figure 47. Recent timber harvest in the inner gorge of a tributary to the North Fork Mattole caused slope failure with major contributions of sediment to the stream.

A Restricted Harvest Band of 30 feet is completely inadequate as explained above. If the zone has been extended to 100 feet that is an improvement but still likely insufficient to protect coho salmon (Spence et al., 1996). PH-23 CON.

- **"Class II streams will have a 130 foot riparian protective zone within which the inner 10 feet will be a restricted harvest band and the outer 90 feet will be managed according to PL's late seral prescription, except the minimum 240 square feet basal area retention will be calculated based upon the entire 100 foot zone." Harvest in outer bands are the same as those in Class I streams. (V1 70 ,of 106).** PH-24

Note: The RHB may extend to 30 ft. on Class II streams due to final negotiation with California Legislature, although there is nothing in the Plan that confirms this.

Federal protections for Class II streams under FEMAT (1993) are the same as for Class I streams; no timber harvest out to two site potential tree heights or to the top of the inner gorge. The RHB in Class II streams in the HCP extend only to ten feet and there is no prohibition of timber harvest in inner gorge locations. Even if the RHB extends to 30 feet, it is still well short of sufficient to protect riparian functions necessary to maintain coho salmon and other sensitive riparian species. The same problems for microclimate, water temperatures, landslide prevention and recruitment of large wood advanced for Class I streams apply to Class II streams as well.

In addition, Class II streams are those which harbor tailed frogs and southern torrent salamanders. Both FEMAT (l993) and Spence et al. (l996) note that riparian buffers greater than one site potential tree height are necessary to protect sensitive amphibian species. The Default Strategy for Lands Not Covered by Watershed Analysis (V4D S3 5 of 18) states that monitoring of Class II streams must be conducted to determine if protections are suffcient for amphibians and that different prescriptions may be necessary in different WAA's. In fact Redwood Sciences Lab studies in the Mattole Basin have shown clearly that tailed frogs and southern torrent salamanders are already reduced to remnant levels in that basin (Welsh, 1990). Furthermore, their experiments with riparian air temperatures and related water temperatures show clearly that these animals have been lost in streams where timber harvest has taken place (see below).

- **Class III streams will be afforded no buffer zone except that heavy equipment will be prohibited from operating within the water course. The equipment exclusion zone is 25' on slopes less than 30%, 50' on slopes 30-50% and 100' on slopes on slopes over 50% slope. No controlled burns are allowed in the area of the active channel. (V1 76 of 106)** PH-25

Problems arising from timber harvest in Class III streams under the HCP are likely to be the most damaging aspect of the entire Plan. Class III streams on Federal land are given one site potential tree height of protection or to the height of the inner gorge. Spence et al. (1996) note that "Impacts of logging can be reduced if buffer zones are left around small headwater streams that themselves do not support salmonids (Cummins et al., 1994). In particular, steep headwater drainages are frequently the trigger points of landslides. Minimizing road construction and logging around first order and temporary channels can prevent frequent mass soil movements that propagate downstream, to the detriment of salmonids." Previous timber harvest in Class III streams on PALCO lands have created substantial problems because of disturbance of soil with

Economics is the primary justification offered in the HCP for continued timber harvest in riparian zones. While FEMAT (1993) and Spence et al. (1996) point out the linkage between riparian areas and maintaining essential functions for salmonids and other aquatic species, the company ignores these factors and does not present data to show that prescriptions offered will provide needed protection. These points raised in the HCP show that whole process of negotiation with the agencies over riparian protection was skewed away from a scientific basis in favor of an economic basis. PH-27 CON.

- **"The FEMAT team intended that the riparian buffer widths recommended in their analysis would serve as 'interim' widths only, pending the outcome of watershed analysis." (V4D 98 of 132)** PH-28

Dr. Leslie Reid, one of the architects of the FEMAT report, recently commented on the sufficiency of the HCP riparian protection methods in a letter to the California Legislature (1998a). In that correspondence, she noted that riparian protections on Federal lands would not change appreciably under Watershed Analysis and that the "the prescribed widths are considered to approximate those necessary for attaining the Aquatic Conservation Strategy Objectives [on permanently-flowing streams]. Post-watershed analysis riparian reserve boundaries for permanently flowing streams should approximate the boundaries prescribed [by the interim specifications]" (ROD pg. B-13).

- **"Although the effectiveness of RMZs as a mitigation method is well established, the width and management restrictions necessary for RMZs to protect streams is still in question." (V4D 57 of 132)** PH-29

- **"The FEMAT team was trying to develop an aquatic strategy that would apply to all forests within the range of the northern spotted owl...... PL's aquatic strategy is meant to apply only to its lands on the North Coast of California." (V4D 98 of 132)**

- **"Numerous studies have shown that a buffer extending from the stream edge inland 30 ft provides more large woody debris than all other portions of the buffer combined." (V4D 57 of 132)**

- **"Castelle and Johnson reported that the first 5 to 25 m of RMZ vegetation provides the most (50 - 75% effective) benefit for sediment and chemical removal. For source functions, they reported that RMZ widths of up to 25 m provide approximately 75% of LWD, POM, and shade production." (V4D 57 of 132)**

- **"WADNR 1996 review concludes that RMZs equivalent to 40-60 percent of site potential tree height are sufficient to maintain riparian ecosystem functions important to fish and wildlife." (V4D 57 of 132)**

- **"The search for this 'dual goal' strategy was aided by a significant body of scientific research showing that many of the benefits of RMZs decrease rapidly as one moves away from the streambank or floodplain."**

heavy equipment. Lack of timber retention and disturbance within 25 feet of these ephemeral watercourses allows substantial contributions of sediment to downstream reaches during major storm events (Figure 48). Problems with extensive logging is pervasive across PALCO property, as was evident from analysis using the KRIS Coho MAP project. Figure 49 shows the riparian zone of Corner Creek showing vegetation on 90 meters of the stream. It is apparent from the predominance of shrubs, grasses and bare soil that logging has been extensive on Class III streams. PH-25 CON.

Operation of equipment would be allowed in Class III streamside areas as part of the prescription "if less resource damage will occur by operating in the equipment exclusion zones (EEZ)". Soil compaction and loss of filter capacity would undoubtedly result, which could in tum cause changes in ground water storage and increased sediment discharge during winter. It appears that equipment operation within the EEZ would also be allowed on 30-50% slopes and greater than 50% slopes in Class III riparian zones, where destructive impacts would be even greater.

Although the NMFS take avoidance guidelines for coho salmon for forestry related issues have not been officially released, a document dated June 25, 1997 has been circulated for review by the timber industry. The draft take avoidance guidelines call for a 100 foot buffer on Class III streams with a no cut buffer of 25 feet.

- **After watershed analysis "Class I streams will have a maximum 170' RMZ width on Class I watercourses, horizontal measurement with 0'-30' Restricted Harvest Band and 30'-170' post-analysis prescriptions (RHB may range from the California Practice Rules to no harvest). Class II will have a minimum 130' RMZ with the 10' closest to the stream in a restricted harvest band and 30'-130' post-analysis prescriptions may range from the California Practice Rules to no harvest." (V4 Section 5 5 of 6). Note: RHB may extend to 100 feet for Class I and 30 feet for Class II as a result of California Legislature actions.** PH-26

Although agencies will participate in the watershed analysis process called for in the HCP, PALCO will set prescriptions for timber harvest after the studies are complete. The literature shows clearly that riparian protections under the "default strategy" are already insufficient to maintain cool ambient air temperatures and to provide maximum cooling influence for streams, allow for recruitment of large wood into the stream and to protect sensitive amphibians. Further depletion of large conifers through timber harvest in the LHB and OB will fall even further from the best scientifically justified protections in FEMAT (1993) and Spence et al. (1996).

- **"The Endangered Species Act requires that an applicant for an incidental take permit 'minimize and avoid take to the maximum extent practicable.' As PL and its agency counterparts met to design the aquatic conservation strategy, both sides recognized that this practicability clause necessarily excluded any RMZ strategy that would result in significant economic harm to the company. (V4D 58 of 132)** PH-27

- **The Northwest Forest Plan "Aquatic Conservation Strategy would .... not be appropriate for application to PL's lands because it would result in severe economic impacts." (V4D 98 of 132)**

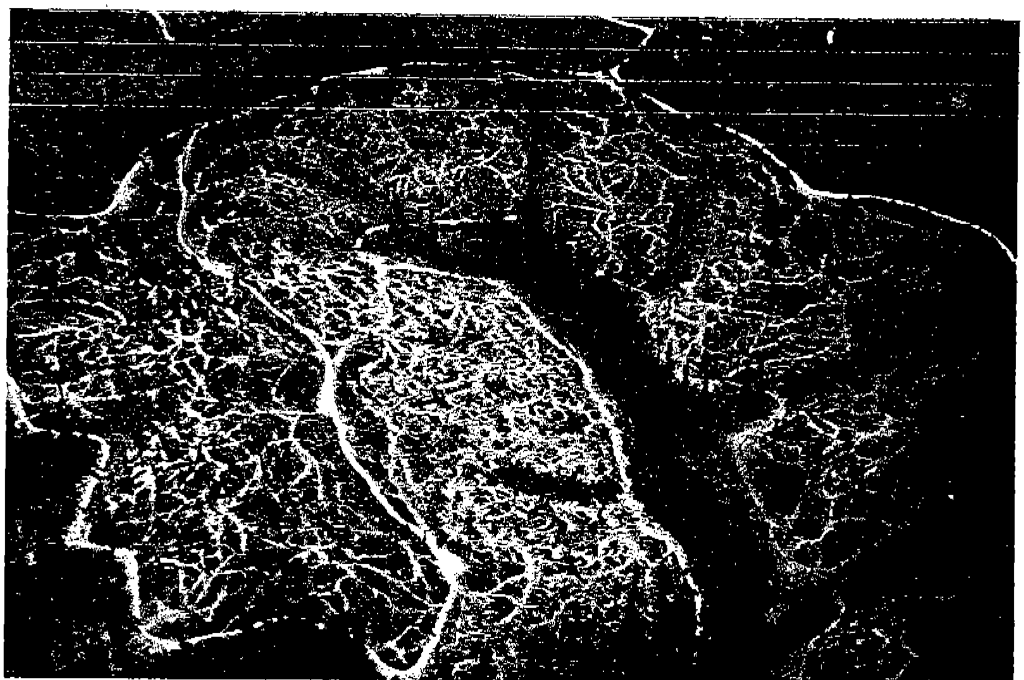


Figure 48. This aerial photograph shows gives an example of a riparian zone on Class II and Class III streams on PALCO lands. Lack of buffer width on Class III streams leaves a pathway for sediment during storm events from surrounding areas disturbed by logging.

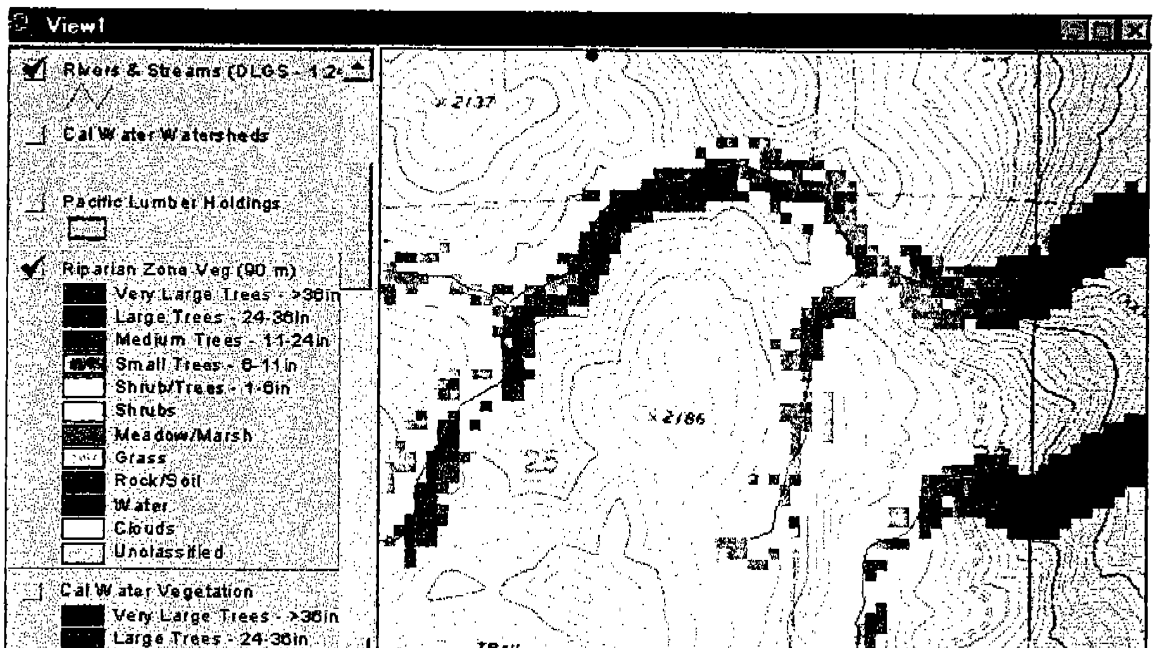


Figure 49. This image is of the riparian zone of Corner Creek with vegetation classification derived from Landsat that has been clipped to 90 meters on each side of water courses (270 feet). Shrubs, grasses and bare soil in this zone is indicative of disturbance related to logging. From HSU and KRIS Coho MAP project.

The PALCO HCP makes a number of arguments that suggest that "most" of riparian functions can be maintained with partial protection of riparian zones, but it presents no specific data to show the sufficiency of this strategy. By treating various benefits provided by the riparian zone as commodities that can be metered, the HCP fails to recognize the importance of over-all riparian ecosystem function. The HCP states that the extent of riparian protection needed has yet to be defined, yet FEMAT (1993) and Spence et al. (1996) clearly explain why protection needs to extend to a minimum of one site potential tree height. Table 3 shows all alternative riparian protection strategies offered under FEMAT (1993) as compared to those offered in the PALCO HCP. Federal scientists rejected Option 8, which protects substantially more riparian area than that offered in the PALCO HCP.

PH-29 CON.

Table 3. Riparian buffer protection in site potential tree heights for options under the Northwest Forest Plan compared to those offered in the PALCO HCP.

	FSEIS Alternative										
Stream Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9****	**10**	**PALCO HCP**
Class I Stream	2	2	2	2	2	2	varies	2	2	2	1/2
Class II Stream	1	1	1	1	1	1	varies	1/2	1	1	1/8
Class III Stream*	1	1, 1/2	1, 1/2	1	1, 1/2	1, 1/2	varies	1/6	1	1, 1/2	0

* Double entries for Class III streams indicate different prescriptions are used for certain types of "Key Watersheds"
**Option 9 was selected as the basis for the Northwest Forest Plan, as described in the Record of Decision, 1994.
Chart adapted from Reid, 1998.

The HCP acknowledges that "the loss of LWD from riparian harvest is likely one of the most significant impacts of PL's past and future harvest activities to fish" (V4H 10 of 132). Nevertheless, harvest of large trees is still recommended inside one site potential tree height. Reid (1998a) noted the potential problems with the prescriptions for riparian timber harvest advanced in the HCP with regard to large wood recruitment:

> " In particular, periodic removal of selected trees from within the zone capable of contributing woody debris to channels will lead to uncharacteristically low volumes and small sizes of woody debris in channels, thus altering channel form, in-stream habitat, sediment transport regimes, and flood hydraulics. In addition, thinning of the canopy may lead to a decrease in the overall wind-firmness of the stands, thus introducing the possibility that woody debris inputs may begin to result from pulses of widespread blowdown rather than from more dispersed instances of individual tree mortality. Under such a regime, debris sizes are likely to be smaller than appropriate, and the channel may shift between phases of severe overloading of debris and phases of depletion after the pulsed input has decayed and before the new stand is old enough to begin contributing significant wood."

The HCP also fails to fully recognize the extremely low levels of large wood in streams on their property. Figures 50 shows riparian conditions at Yager Creek where sources of large wood are so depleted that it will take many decades before any wood of appropriate size is available to recruit. Figure 51 shows similar low volumes of large wood on PALCO lands in the riparian zone of the lower North Fork Yager Creek. Therefore, no strategy of large wood removal can be justified from within one site potential tree height of Class I and Class II streams on PALCO land. PH-29

While the HCP claims its aquatic strategy is specific to northwestern California, it cites Washington State studies that indicate that retention of 40-60% site potential tree height provide "functions important to fish and wildlife." California has a much warmer climate than Washington and, therefore, it is likely that data related riparian protection and its effects on water temperature is not transferable. PALCO must provide specific data, collected in northwestern California, showing that cool microclimates over streams would be protected and that buffering of stream temperatures from surrounding warm summer air temperatures can be provided with the riparian protections offered under the HCP. Data of this type has been collected for the Mattole River Basin by the U.S. Forest Service Redwood Sciences Lab (see below). It shows that maintenance of a multi-tiered canopy of conifers well back from the stream is necessary to provide cool water temperatures and microclimate needed to protect sensitive amphibian species, such as the tailed frog, require .

Spence et al. (1996) note that streams that exceed the normal range of variability for temperature need a period of recovery that includes a shift in emphasis away from commercial timber harvest in riparian zones. Given the critically high water temperatures over much of the PALCO ownership, no riparian harvest that influences increases in stream temperatures should be allowed.

- **"Temperature is the variable of concern in evaluating logging impacts to riparian function. However, by agreement with the agencies, canopy cover is being used as a surrogate variable to assess the likely effectiveness of various HCP proposals to protect water temperatures. This was done because: I) stream shading from the riparian canopy is a major determinant of water temperatures (i.e., the variables are directly related); 2) more extensive datasets are available for canopy cover as a function of riparian vegetation than for temperature; and 3) PL cannot manage for temperatures, which are strongly influenced by site specific variables (e.g., distance from ocean, air temperatures, stream discharge, etc.), but it can manage for canopy cover." (V4D S5 10 of 53)** PH-30

The HCP fails to consider the effect of ambient air temperature on water temperature and operates under the false assumption that only direct shade effects warming of streams. Bartholow (1989) showed that maximum stream temperatures are most influenced by ambient air temperatures then relative humidity. Direct shading is the third most important factor. Spence et al. (1996) confirm the importance of riparian vegetation in temperature control of streams: "Riparian vegetation modifies convective and evaporative heat exchange losses by creating a microclimate of relatively high humidity, moderate temperatures, and low wind speed compared to surrounding uplands. These microclimate conditions tend to reduce both the convective and evaporative energy exchange by minimizing temperature and vapor-pressure gradients."

Figure 50. Mainstem Yager Creek aerial photograph showing the depleted condition of riparian zones on PALCO property.

Figure 51. Lower North Fork Yager Creek aerial photograph showing intensive logging in the riparian zone of this stream.

Recent experiments from Redwood Sciences Lab in Arcata show the importance of maintaining a multi-storied canopy over streams in order to maintain cool water temperaures. Temperature probes were placed in numerous Mattole River tributaries with canopy conditions of late seral, second growth and mixed forest and grassland. Probes were placed one meter from the stream, ten meters, twenty meters, thirty meters and forty meters (Figure 52). Results of air temperature surveys under various canopy conditions are presented in Figure 53. This survey shows that air temperatures in riparian zones of late seral forests are much cooler than those in second growth forests or mixed forest and grassland. Welsh showed that water temperatures in streams with a canopy in late seral conditions stayed within a range suitable for coho salmon (Figure 19). Water temperatures in second growth streams were also measured and water temperatures higher than suitable for coho salmon (Figure 20). It is apparent that air temperature over streams is driving water temperature. The PALCO HCP fails to recognize this vital linkage and, therefore, all timber harvests in LHB and OB areas of Class I and Class II streams are without scientific justification. PH-30 CON.

Redwood Sciences Lab studies also showed that temperatures in second growth streams exceeded limits of tailed frogs (18.5 C) and southern torrent salamanders (17.2 C). Although the PALCO HCP states that it will maintain cool air temperatures (<22 C) and high relative humidity over streams with either of these species (V1 78 of 106), it presents no scientific evidence that these conditions can be maintained with the planned timber harvests in Class II riparian zones. Redwood Sciences Lab studies also showed that tailed frogs and southern torrent salamanders were greatly reduced in second growth forests (Figure 54). Welsh (1990) showed that tailed frogs and southern torrent salamanders were on the verge of extinction in the Mattole River watershed.

- **The trigger for identifying when such changes will be considered shall be the approval by the agencies of a plan, whether through an HCP process, a biological opinion process or any other process, which imposes on a private timberland owner in the Southern Oregon/Northern California Coast ESU for coho salmon prescriptions that are less restrictive than those imposed on PALCO (V4D 117 of 132).** PH-31

Riparian protection under the PALCO HCP is not fixed, the company asserts, but rather it will be open to negotiation as other HCP's are shaped. The protection of riparian zones under the HCP is already insufficient yet there is no certainty that even these levels will be attained.

<u>**Will the way the HCP deals with riparian issues meet the standards of CEQA and avoid jeopardy to coho salmon under ESA?**</u> PH-32

Riparian protection under the HCP is insufficient to help maintain cool stream temperatures for coho salmon and will also hinder recruitment of large wood into streams. Therefore, the HCP riparian management strategy is likely to cause jeopardy to coho salmon. Given that all these activities will take place within 300 feet of the streams harboring coho salmon, they will substantially degrade habitat designated as critical by the Secretary of the Interior. Failure to prohibit timber harvest in Class III streams and in inner gorge areas will create contining problems with excessive delivery that are likely to cause the extinction of coho salmon throughout PALCO's property. The HCP's repeated assertions that only direct shade controls water temperature shows that the document clearly does not use the best sciencific and commercial information available. The current condition of riparian zones on PALCO lands are much more seriously degraded than

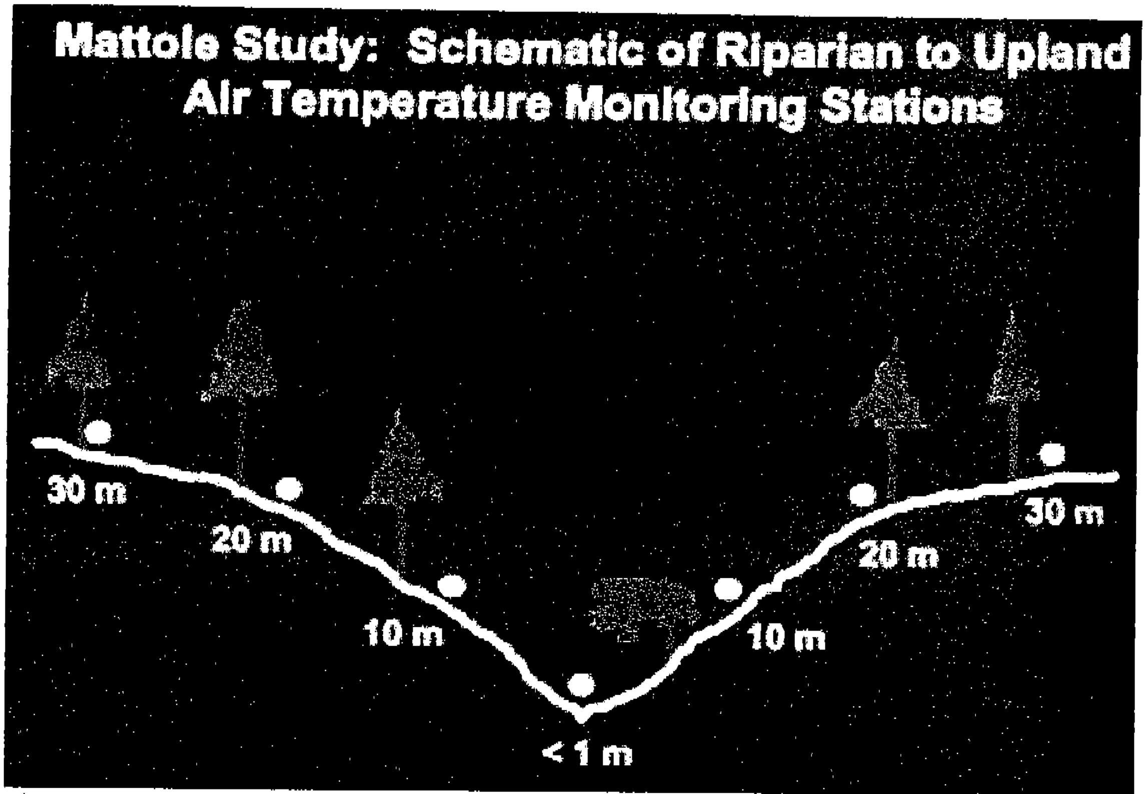


Figure 52. Shows how air temperature probes were arrayed in riparian zones of Mattole River tributaries with canopies of various seral stages. Graphic provided by Dr. Hart Welsh of USFS Redwood Sciences Lab from work in progress.

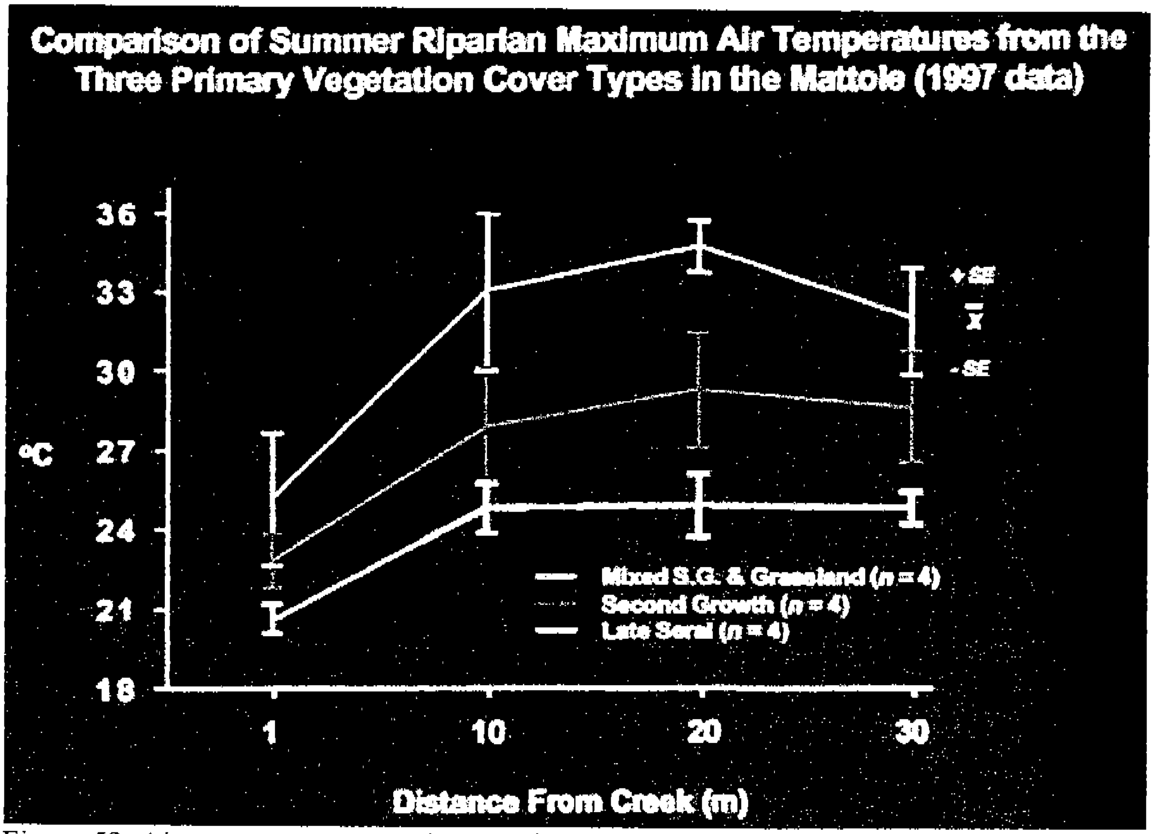


Figure 53. Air temperatures over late seral streams rarely exceeded 21 C while air temperatures in second growth streams reached as high as 24 C. Air temperatures in turn drive water temperatures. Data from Redwood Sciences Lab.

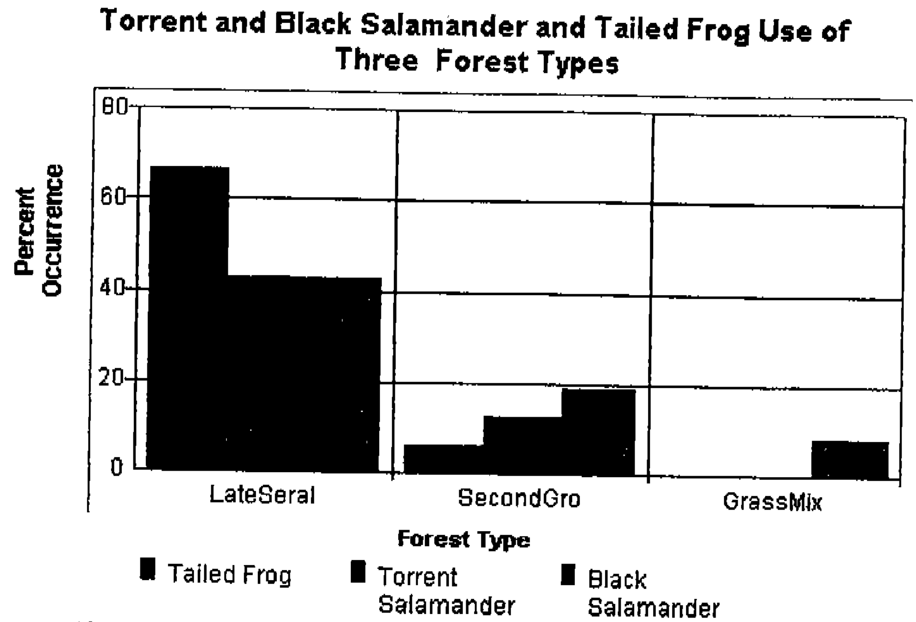


Figure ~~53~~ 54. This chart shows that tailed frogs and southern torrent salamanders have been substantially reduced by timber harvest. Data from Dr. Hartwell Welsh of Redwood Sciences Lab from work in progress.

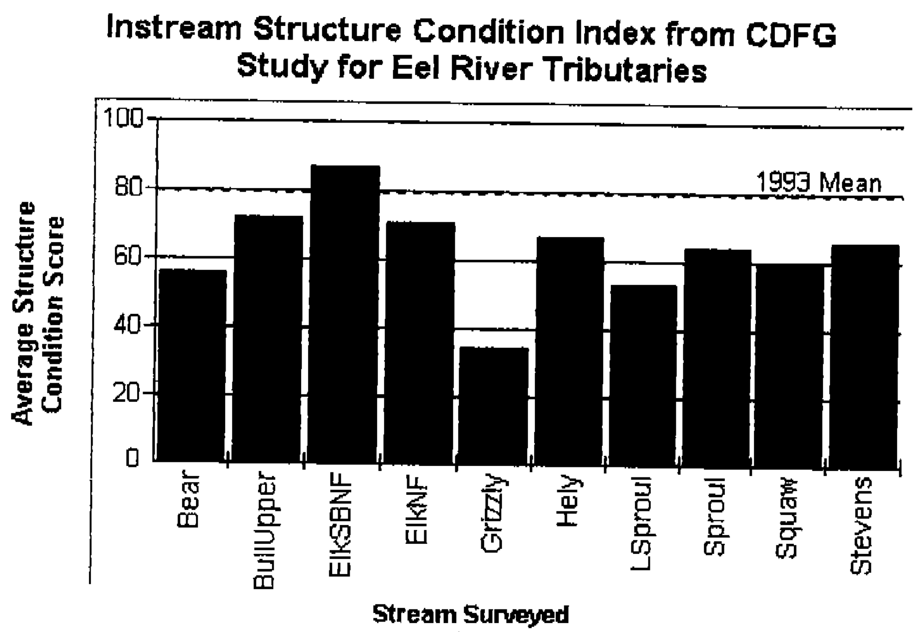


Figure 55. This chart shows that failure of instream structures on Grizzley Creek had already exceeded 60% only two years after installation. Data collected by CDFG in 1993 and 1995. No data is available from after 1997 when some streams like Bear Creek lost almost all structures due to debris torrents.

the PALCO HCP acknowledges. Consequently, the HCP fails to meet CEQA requirements with regard to cumulative effects. PH-32 CON.

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